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The Production of Small Parts By Centerless Grinding

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Some examples of centerless grinding, together with figures on production—Methods of handling odd work—Grinding tungsten bars

THE ART OF grinding metals, which for many years was considered so standard that there appeared to be only one way of handling a grinding job, has undergone so many changes in the last three or four years, that no one can say with certainty what can be done or what can be expected next. In the old days, grinding constituted a trade in itself, but now the latest types of machines have reduced what was almost a science to an operation. The human element which entered into the grinding of a piece of work by an operator who placed one piece of work at a time into the machine and turned the feed wheel as his conscience dictated, has been eliminated by a machine into which the work is fed through a trough. And there will undoubtedly be other changes, just as radical, in the next few years.

One job, which, because of its simplicity of design is being done almost universally on centerless grinding machines, is the automotive piston pin. Some shops use only the centerless machines while others, such as the Standard Gear Co., Detroit, Mich., use a center machine for the first operation and centerless machines for the subsequent operations. This shop uses a Norton grinding machine for the first operation, as shown in Fig. 1. The diameter of the pin is ⅞ in. and the amount of stock removed is 0.025 in. The production on this operation is 100 per hr., the wheel (a Norton combination M) being dressed for every 65 pins.

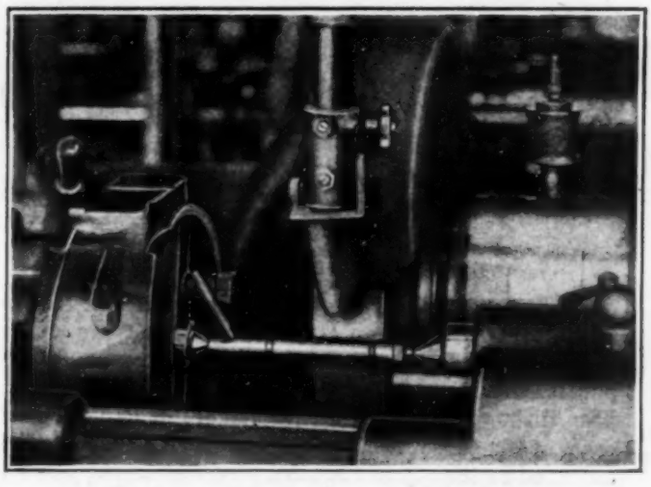


FIG. 1—ROUGH GRINDING PISTON PINS

The second operation is shown in Fig. 2, the machine being a Cincinnati centerless grinding machine. The work is held between the wheels by a rest, as shown and is passed into the machine at the front side and fed through and out of the rear of the machine by the action of the feed wheel. The wheel used is an Aloxite 80 K.C.

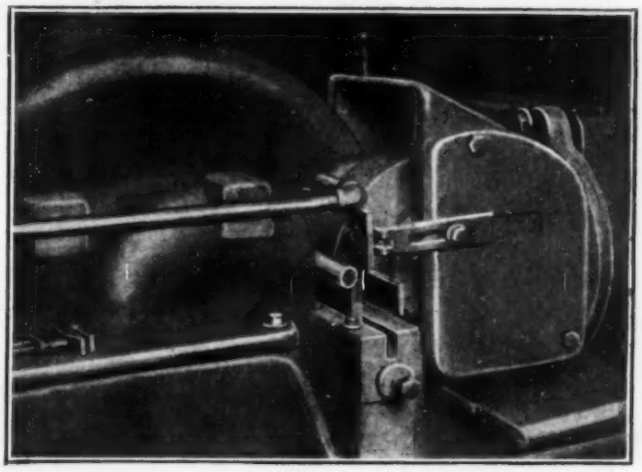


FIG. 2—SECOND OPERATION—CINCINNATI CENTERLESS GRINDING MACHINE

The production on this operation is 250 per hour and when the pins leave the machine they are within 0.001 in. of the desired size. Fig. 3 shows the work leaving the machine. The third or finishing operation, shown in Fig. 4, is being performed on a Detroit centerless grinding machine. In the Detroit machine, the grinding wheel is directly over the feed wheel, which controls the rotation of the work as well as the speed at which it passes through the machine. The grinding

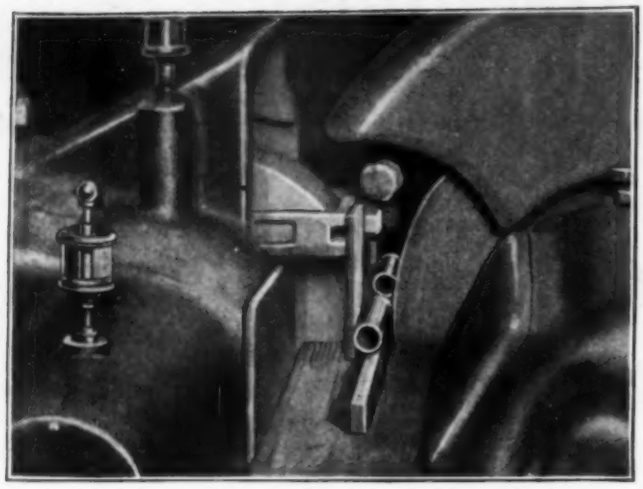


FIG. 3—WORK LEAVING THE MACHINE

wheel rotates at the same peripheral speed as would be used under similar conditions in a standard machine of the center variety while the operator has a choice of three rotating speeds, according to the finish required and the amount of stock to be removed. The speed at which the work travels through the machine is regulated by the angle at which the feed wheel is set. The face of the feed wheel is twice the width of the grinding wheel so that the work will be revolving both when it engages and leaves the grinding wheel, thus precluding the possibility of flat spots on the ends of the work. The wheel is special for this machine and the production is 350 per hr. The pins are held to a tolerance of 0.002 inch in this operation.

The machine shown in Fig. 5 is a Heim centerless grinding machine, at work on gear shifter rods in the plant of the Mechanics Machine Co., Rockford, Ill. The rods are of steel, 0.687-0.687x5⅞ in.

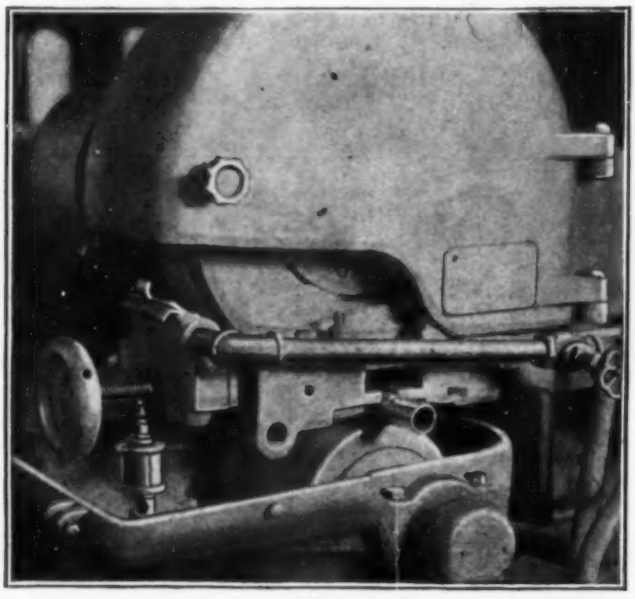


FIG. 4—FINISHING OPERATION—DETROIT CENTERLESS GRINDING MACHINE

and are passed through the machine twice, removing about 0.005 in. the first time, and approximately 0.001 in. the second time, obtaining a fine finish. The total production is 275 pieces per hr. The production is raised to 450 pieces per hour on similar work on which the requirements as to finish are not quite so strict, making it possible to finish the work in one pass. The feed wheel is a 120-C "Vulcanite" (New York Belting and Packing Co.), and the grinding wheel is a 6,600-L Norton.

This machine is also used to grind flange yoke-pins, which are 0.6875-0.6865x3.936 in. These pins are fed through the machine three times at a rate of 650 pieces per hr. for each pass. In the first pass, 0.005 in. of stock is removed, in the second pass, 0.0025 in. and in the third pass 0.0005 in., making 0.008 in. altogether. It is confidently expected that production on this job will be brought up to 3,000 pieces per day.

The job shown in Fig. 6 is that of grinding motor-

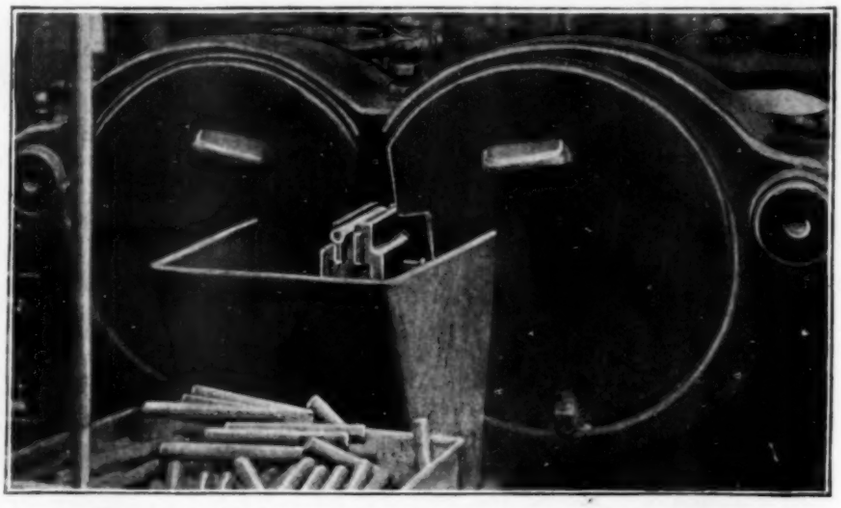


FIG. 5—GRINDING SHIFTER RODS ON A HEIM CENTERLESS GRINDING MACHINE

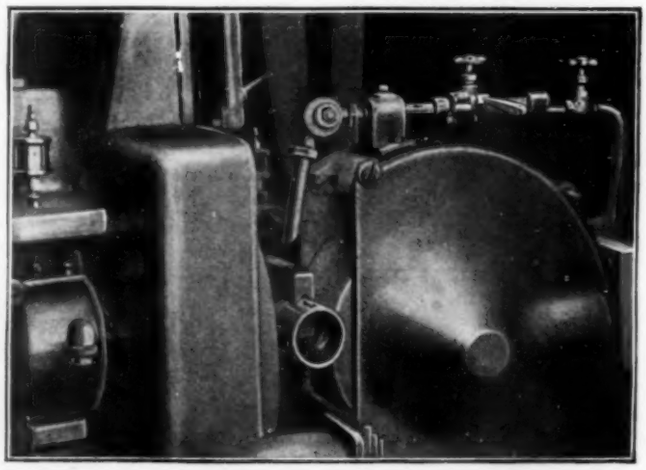


FIG. 6—GRINDING PISTONS ON A REEVES ROLL GRINDING MACHINE

cycle pistons in the plant of the Excelsior Motor & Manufacturing Co., Chicago, Ill. The pistons are of cast iron, 2 11-16 in. in diameter, and are ground in three passes, removing 0.005 in. of stock at each pass. They pass through the machine at the rate of 270 per hr. in each of the first two passes and then the wheels are adjusted so that 70 per hr. are produced in the last pass,

FIG. 7—GRINDING ROLLER BEARINGS

the extra amount of time required to remove the same amount of stock being sufficient to produce the finish required. Norton wheels are used, a 60-M wheel for grinding and a 120-W wheel for feeding.

The operator shown in Fig. 7 is feeding roller bearings to a Detroit No. 4 centerless grinding machine. The diameter of the stock as it comes to the machine is 0.953-0.960 in., and the machine is set so that the first pass reduces the diameter to 0.950 in. In the second pass, 0.007 in. of stock is removed, 0.005 in. in the third and the fourth or finishing pass reduces the size to 0.9368 in., with a minus allowance of 0.0017 in. The pieces pass through the machine at the rate of ten per minute, which is 600 per hour. The total production is 150 finished pieces per hour. The grinding wheel used on this job is a No. 50-0 Carborundum, running at

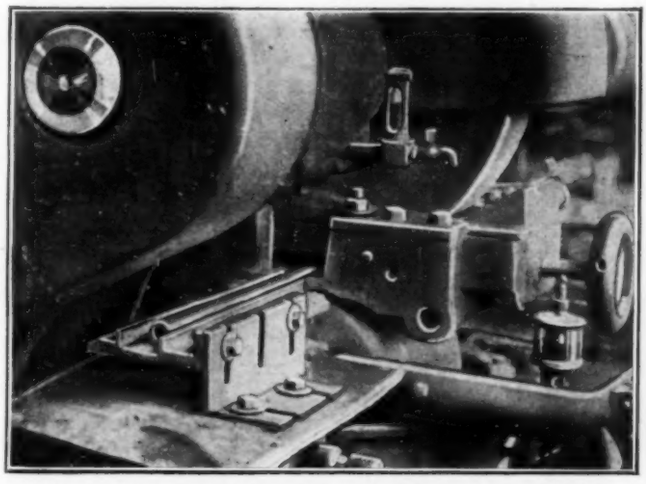


FIG. 8—VIEW SHOWING OPPOSITE SIDE OF MACHINE

5,000 ft. per minute. The peripheral speed of the feed wheel varies from 35 to 45 ft. per min. on a job of this kind, depending on the amount of stock to be removed and the finish required. The illustration Fig. 8 shows the work coming from the machine.

Rollers of the same type as those shown in Fig. 7 but only $\frac{7}{16}$x1$\frac{7}{16}$ in. are ground in the machine shown in Fig. 8, at the rate of 3,600 finished pieces per hour. The amount of stock to be removed averages 0.015 in., and is removed in one cut, the finish size being held within 0.001 inch.

The illustration, Fig. 9, shows a Detroit machine set up to grind cam rollers. The rollers are $\frac{1}{4}$ in. thick and 0.748 in. in diameter, with an allowance of plus 0.002 in. This machine is of a different type and has no feed wheel. A block is bored out to a sliding fit for the rollers, with the front exposed so that the wheel can contact properly with the work which is fed to the machine through the steel tubes, as shown. The tubes are loaded and are then slipped into holes in the end blocks as may be seen in Figs. 9

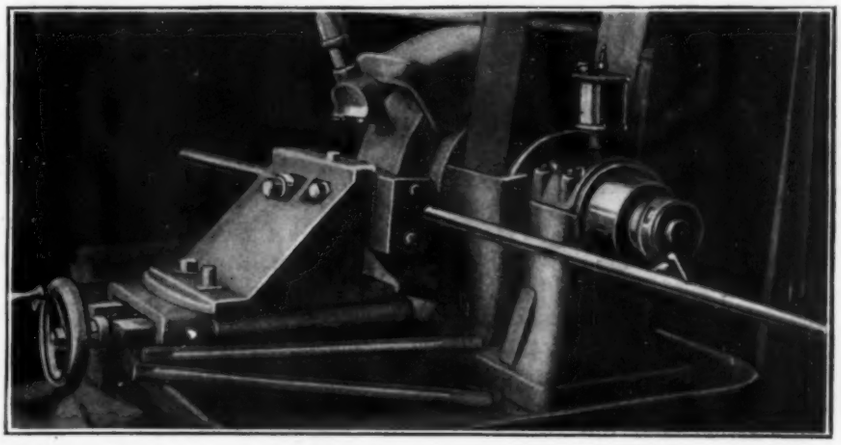


FIG. 9—GRINDING CAM ROLLERS

and 10, and a rod is used to push them along. The rod is shown sticking out of the tube in Fig. 9. As the rollers pass the wheel, they slip into another tube and when this is full it is removed.

Among other interesting jobs done on the Detroit machine is that of grinding a number of tungsten bars for the Edison Lamp Works. These bars come to the machine in sections three feet long and approximately 0.016 in. in diameter. The size is reduced by 0.004 in. in the first pass and 0.002 in. is taken off in the second pass, these amounts being just enough to "clean up."

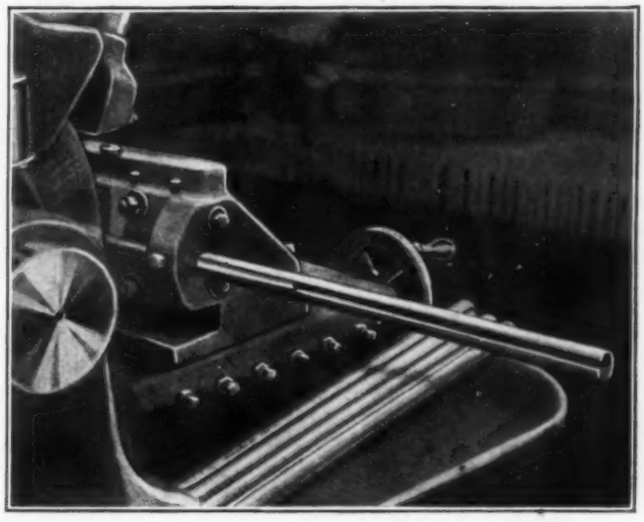


FIG. 10—WORK LEAVING THE MACHINE

Industrial Unemployment—A Statistical Study of Its Causes

THE NUMBER of unemployed in September, 1921, was reported by the President's Conference on Unemployment, at its first session, September 26, 1921, in Washington, D. C., as between 3,500,000 and 5,500,000, with a much greater number of persons dependent upon those out of work. No attempt was made to estimate the number of these dependents, but on the basis of 30,000,000 employees in a total population of 105,000,000, the number should be between 10,000,000 and 15,000,000.

In the field of industrial employment there are four distinct movements or trends, all of which are going on at the same time. There is a gradual increase in the total number of employees growing every year with the increase in population, and the augmented demand for manufactured goods. Two other movements are the seasonal variations and the fluctuations due to business depressions. The fourth movement is the labor turnover within the factory or plant whereby some workers are constantly taking the place of others, by virtue of dismissals, voluntary leaving, or other forms of separations.

Four Results

The first force increases steadily the total number of persons employed. The second tends to high employment during certain busy seasons and low employment during slack periods; the third to over-employment during periods of prosperity or high pressure and marked under-employment during times of dull business and depressions; and the fourth to a turnover of labor within each particular manufacturing plant. As an example of the first force, between 1899 and 1914, the number of wage earners in manufacturing industries in the United States increased from 4,712,000 to 7,036,000, an increase in 15 years of 49.3 per cent. The percentage of increase between 1914 and 1919 was abnormal.

Partial unemployment occurs in small units, but in the aggregate is responsible for a large volume of lost time and reduced earnings. It takes two forms, part-time employment and the time lost on account of waiting and other causes. Disability due to sickness or accidents and to strikes or lockouts causes additional loss of time and should be taken into account in any comprehensive estimate of the factors in unemployment.

A considerable proportion of unemployment is due to seasonal fluctuations in the labor market and to business depressions which at times sharply lower the entire level of demand for labor. The seasonal fluctuations may be divided as follows: Those caused by conditions limiting production, such as the perishable character of raw materials, the weather or the size of the plant; those caused by conditions of demand or consumption such as the changes in style, in the buying habits of people, or in the character of goods. The reduction in the degree of seasonal unemployment in some instances appears to have been accomplished by:

(1) "Smoothing" the market—making the demand more even by spreading orders over more months of the year or by developing other products used in a different season.

(2) Making output more uniform and stabilizing production by storage.

(3) Where neither of these methods is possible, stabilized employment may be promoted through training employees to do two or more jobs.

The business cycle of "boom" times and depressions or panics, is the result of a series of complex causes. These depressions have come at more or less regular intervals, but are now and then being interfered with by economic forces which are only partially understood.

Two striking facts stand out from the data available regarding labor turnover:

(1) In a very large number of factories, the number of new employees hired during each year to take the place of those who leave is greater than the average total number of employees on the pay rolls during the year.

(2) Three-fourths of all the separations from factory pay rolls are made on the initiative of the employee.

Unemployment, affecting as it does the continuity of both production and distribution, concerns the manufacturer and merchant as vitally as the wage earner and the public. The lowering of the demand level and the standard of living of thousands of workers, which accompanies a severe depression such as the present one means fewer comforts in regular demand by the wage earner and less future business for all. It is thus to the interest of the entire business community to maintain a reasonably high level of general well-being. Idle men as well as idle machinery, must be "carried" and provided for by those who are busy—either other wage earners or the consumer who eventually pays the bills. Unemployment means a lowering of physical vitality through less adequate sustenance, the reduction of industrial initiative, and a lessening of self-respect. Is it a sound policy to let either the health or the morale of the workers go to pieces?

The principal conclusions arrived at are as follows:

(1) Industrial wage earners in those states for which data are available lose about 10 per cent of their working time through unemployment, mainly from lack of work and exclusive of idleness due to sickness and labor disputes. On this basis, an average of at least a million and a half industrial wage earners in the United States are constantly unemployed, taking poor and prosperous years together.

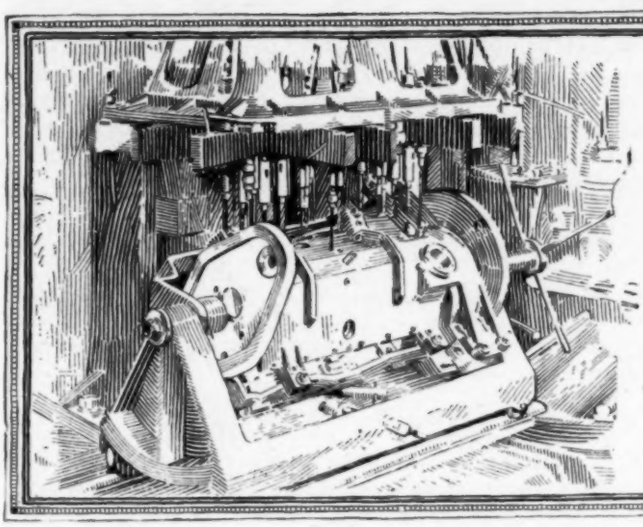
(2) Of the working time of industrial wage earners 2.5 per cent appears to be lost from sickness and other disabilities, and an additional 1 per cent from labor disputes, or an average per worker from these two causes of about 10 days per year.

(3) From such data as are available, it appears that partial unemployment due to part-time operation of plants, to shut-downs, to time lost on account of waiting, and to related causes, is responsible for a loss of about 10 per cent more of the working time of industrial wage earners. There may be some overlapping here with the time lost from sickness and labor disputes.

(4) There is a fairly regular seasonal decrease in employment in the manufacturing industries as a whole in midsummer and again in midwinter.

(5) The unemployment due to depressional factors was more pronounced in 1920-21 than in 1907-8 or 1914-15.

Abstract from Bulletin No. 310, by Ernest S. Bradford, Ph.D., Bureau of Labor Statistics, U. S. Department of Labor.



Tool Engineering

By
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Design of drawing dies concluded—Combined blanking, piercing and drawing dies—Multiple-operation tools—Progressive drawing and piercing dies

A VERY interesting example of a combined blanking and drawing die is illustrated in Fig. 499. The work *A* shown in section in the upper part of the illustration is blanked and formed from the sheet in one operation so that it is completely finished to the form indicated. The die for this work brings out several of the principles which have been described, together with several refinements in design. The work in flat form is shown at *B*, and the positions of the various parts of the die are shown before any pressure has been applied.

The work is gripped between the ejector *C* and the form block *D*, as well as being held between the die *E* and pressure pad *F*. The upward movement of this pressure pad is limited so that it moves upward only to the position indicated. The movement of the ejector *C* is limited by the shoulder *H* which strikes against the counterbored section of the punch. In operation the work is first blanked to size as the punch descends, and being held by the pressure ring *F*, it is drawn and forced into shape by the various members of the die previously mentioned. The types of pressure pins and springs used are similar to those shown at *K* in Fig. 496 in the previous article. The springs are very stiff and allow the work to be very nearly completed before the punch strikes the bottom.

The last forming operation performed is on the raised bead in the center of the work, this bead being made by the punch *L* which forces the work up into the die *M*. The die used in this case is of the sub-press or pillar type, and it is an excellent example of a good die used for a forming operation. The application of the principles previously described can be very readily seen in this example.

Combined Forming and Piercing Dies

Two examples of dies for piercing and drawing in the same operation are shown in Fig. 500. In the example at *A* the work *B*, shown by the heavy line, is first blanked by means of the punch *C* and *D*, the stock being cut from the sheet as in the previous example. It is then pierced by the punch *E* which is located in the die *F*. The latter also is used for forming the under side of the die *C*. The outside form is controlled by the shape of the forming block *G*, and the pressure ring *H* is similar to the examples which have previously been shown. This is a simple example of good die construction in which blanking, piercing and forming operations are carried on at the same time.

In the example shown at *K* the die is used for piercing and forming the work at *L*. Here the outside form

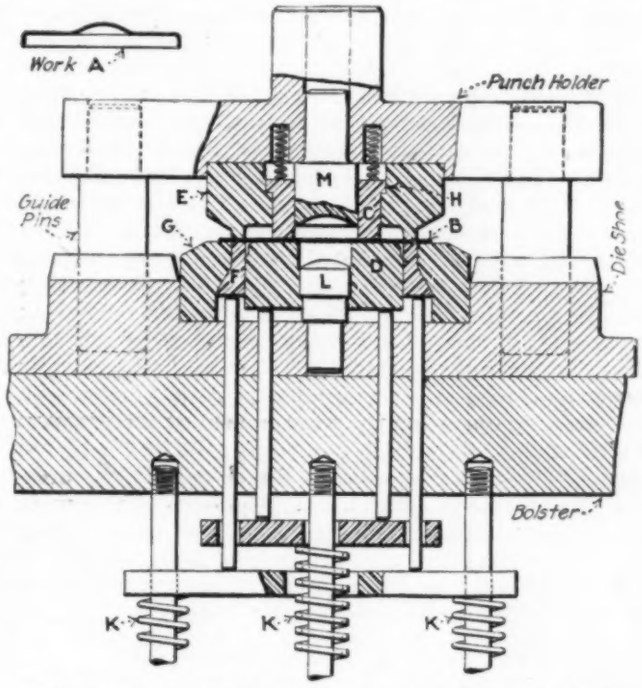

FIG. 499—COMBINED BLANKING AND DRAWING DIE

of the work has a flange on it, and the form is made similar to the example shown above, except that the punch does not descend far enough to draw the metal entirely over the forming block *M*. There is a pressure pad *N* mounted in the punch O. This pad grips the work between it and the forming block *M* and thus prevents wrinkling the stock while the inside form is being produced by the punch *Q*. The latter is provided with an ejector *X* which throws out the slug produced

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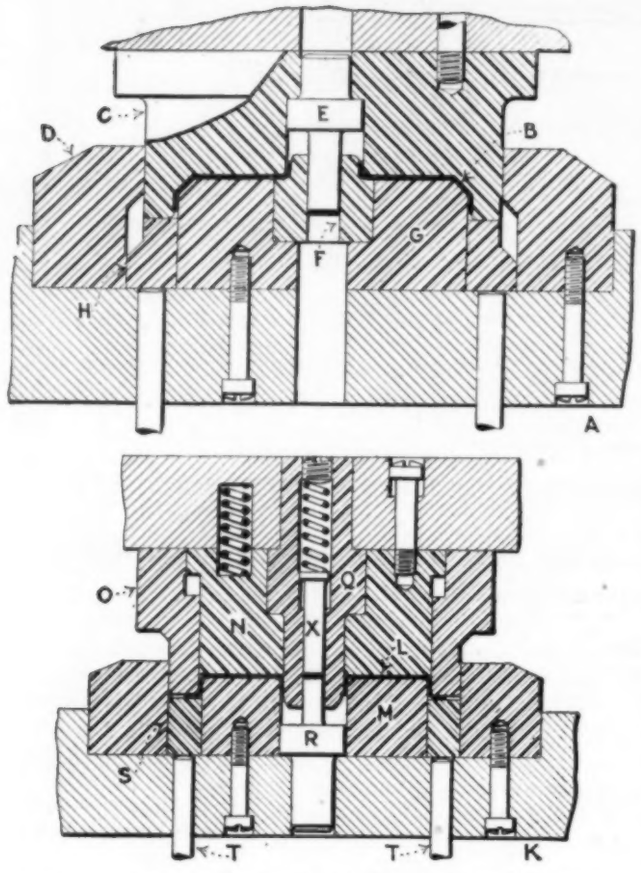


FIG. 500—TWO EXAMPLES OF DIES FOR BLANKING, PIERCING AND FORMING

by the piercing punch *R* as it passes through the work. When the work is completed it is thrown out by the pressure of the various members so that it lies on the pressure ring *S* which is operated by spring pressure through the pressure pins *T*. These two dies are quite similar in their general arrangement and may both be considered as good examples of modern die construction.

In Fig. 501 is shown a die for drawing, piercing and blanking the work *A*, which is a tin box cover. At *B* a sectional view of the work is shown in order to illustrate the form produced. The work is blanked as the punch *C* passes down through the die *D;* and during this blanking operation the work is held by the pressure ring *E* against the punch, and also in the center by the forming block *F* which fits the die *G*, against the pressure pad mounted in the punch. The form of this work is similar to other examples which have been shown, but the construction of the punch and die in general is quite different, as there are more moving parts and the design of the die is more complicated.

Blanking, Piercing and Drawing Die

The reason for the use of the various moving members is to permit the work to draw freely over the different angles and bends which are required. The punch is equipped with a stripper *K* which serves to hold the scrap portion of the stock and the die while the forming operation is in progress. The stop pin *L* locates the work from the previously blanked hole. The stock *M* is shown in position as it lies on the die before the blanking and forming operation. The feeding of the stock is in the direction indicated by the arrow.

When work is to be drawn so that the upper portion of the form is smaller than the lower portion, the die required is of special design. Dies of this sort are sometimes called "bulging" dies, because the work fits over a form which is supported by a rubber cushion, and as the punch forces the work down over this form the rubber is squeezed out in such a way that it bulges and forces the stock into the required shape. There are cases, however, when it is not necessary to back up the work in this manner. This is dependent upon the form required, and if the form is such that a considerable amount of forming is to be done, it will not be practical to attempt an operation of this kind. Fig. 502 shows two examples of dies which perform closing and flanging operations.

Types of Forming Dies

The illustration at *A* shows a piece of work *B* which is to be formed at the outer edge as shown in the section at *C*. The work locates on the ring *D* and is formed by the punch *E* mounted in the holder *F*. The blank is held in position by the pressure pad *G* which is mounted in the punch. The operation consists of closing in the flanges as shown, and if too great a distance is not required for the closing operation an arrangement of this sort will be found satisfactory. If, however, the stock is to be closed-in for a considerable distance there is a likelihood of bad wrinkles being developed, so that the designer on this class of work should be governed by the general form of the work and the amount of the closing-in operation required.

The work *K* shown in the lower example at *H* is a very good example of a die for flanging. This is a closing-in type of die in which the work locates on the plug *L* mounted in the die shoe *M*. The punch holder *N* is furnished with a ring *O* having three support-

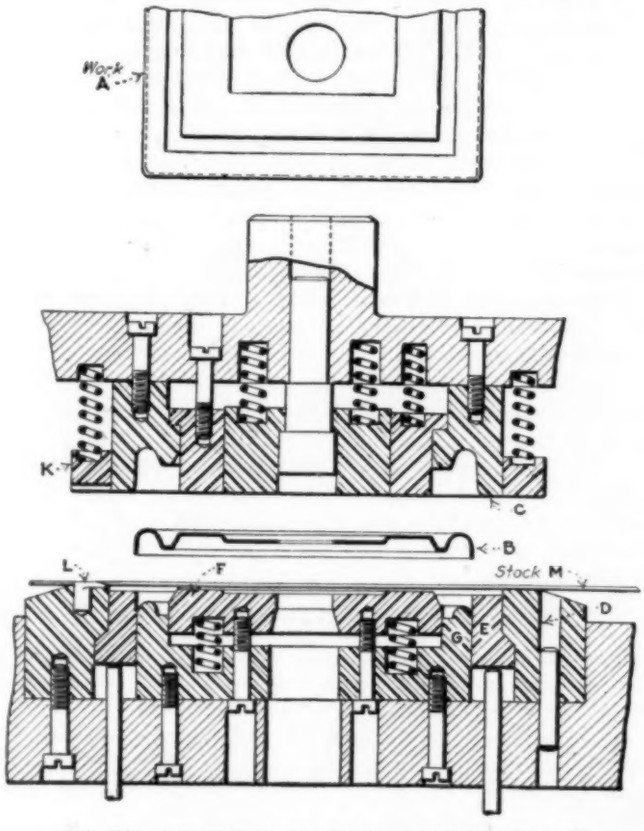


FIG. 501—COMBINED BLANKING, PIERCING AND FORMING DIE

ing forms *P* mounted on it. In operation the punch holder descends, and as it does so the guide pin *Q* forces these supporting forms into the position shown in the drawing. As the downward movement continues, the punch *R*, which is mounted in the punch holder, enters the hole and flanges out the work to the form shown. The supporting forms hold the work while this operation is being done, and prevent it from wrinkling. Unless an arrangement of a similar sort were to be used, very bad wrinkles would develop and the operation would be a failure.

The punch shown here is equipped with a pilot which enters the hole in the work before the flanging operation takes place, thus assisting to support and turn

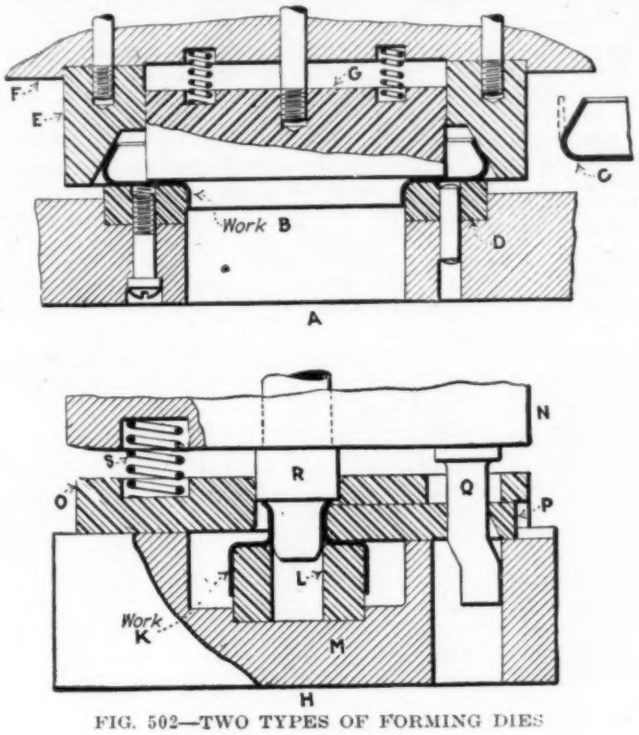


FIG. 502—TWO TYPES OF FORMING DIES

the stock in the proper manner. The operation here is somewhat similar to that of a curling die described in a preceding article. As the punch holder is withdrawn from the work the spring *S* holds the plate *O* against the die until the guide pin *Q* has moved upward far enough to withdraw the supporting forms from the work, at which time the entire unit is removed from the work.

A combination drawing and blanking die for performing progressive operations, and which illustrates the possibilities of dies for this kind of work, is shown in Fig. 503. There are five complete operations performed by this die as follows: (1) Blanking, (2) first drawing operation, (3) second drawing operation, (4) drawing, (5) blanking to size. Ribbon stock is used for this work, and the operation is clearly shown at *A*.

Each of the different operations is performed by a separate punch mounted in the punch holder *B*, and by separate die blocks of unit form similar to button dies which are mounted in the die shoe *C*.

The first operation blanks the portion shown at *D* by means of the punch *E* and die *F*, after which the work continues through the die so that the first forming operation is done by the punch *G* and die *H*. This operation produces the work as shown at *K*, and as the forming operation draws the stock from the sides to

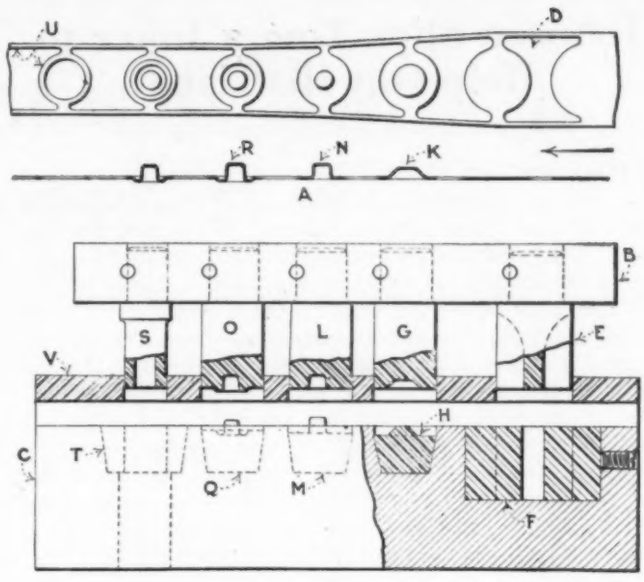


FIG. 503—COMBINATION DRAWING AND BLANKING DIE

some extent the width of the blank becomes narrower as it progresses, as may be clearly seen in the plan view.

The second drawing operation is done by the punch *L* and die *M*, which finish this form of the drawing to the section of the work shown at *N*. The formation of the neck is the next operation, being accomplished by the punch *O* and die *Q*. The result of this operation is that the work is formed into the shape shown at *R*. The final operation is the blanking of the pieces by means of the punch *S* and die *T*. The work at this point passes through the die and die shoe and the stock is carried on through the end of the die.

The amount of scrap made by this series of operations is shown at *U*, and it will be seen that great economy of stock is obtained. A stripper plate *V*, which runs the entire length of the die, is used not only as a stripper but also as a guide for the various punches. The use of the stripper as a guide for the punches has been brought out previously. Many operations of this sort are done on dies of this character. A few well-known examples of such work are snap fasteners, clasps, eye hooks and metal buttons.

We have endeavored to give representative types of dies used for forming operations in this article, but no attempt has been made to illustrate a great number of forming dies, as in the illustrations given the principles are clearly shown. Other forms in great variety would in many cases be similar in the method of procedure, and it does not appear necessary to go into the matter further.

Standard Thicknesses of Sheet Metal

Letter Circular 24, one of the mimeographed circulars of the Bureau of Standards, has just been issued and gives standard thicknesses of sheet metals including steel plate in sheets, galvanized sheets, copper, brass, aluminum, tin and terne, zinc and monel metal. The various sheet metal and wire gages used in designating the thicknesses are also discussed. The circular is a collection into useful form of information that has heretofore been widely scattered and inaccessible. A limited number of copies of this circular may be obtained from the Bureau of Standards.

Johnson Slips Tom a Joker to Help Out His Hand

By John R. Godfrey

I TOLD you how old man Johnson used me as the goat to help put some real, business ideas into Tom's head after he came home from college. Well Tom buckled down in good shape and so the old man decided to take a trip to Miami, for fish and not bootleg booze, which can't be said of all the visitors these days. He'd been wanting to try his hand at tarpon, never having caught anything larger than a good sized perch in his home waters. But he didn't quite forget all he knew of business as you can guess by the letter he wrote Tom in reply to an S.O.S. which the boy sent him last week.

Tom called me in the other day and showed me the old man's letter, likewise a carbon copy of his own which started the old man to handing out advice. Here's what he wrote Dad:

"Dear Dad:

"The boys on the road are reporting quite a lot of business stirring; some of it that they couldn't budge last year seems to be opening up. But here's the fly in the ointment—they report that the price cutting is enough to make your hair curl, 'even if you ain't got no hair.' And it isn't all the little fellows either Dad, some of the big ones seem to be raiding the market. Seems like they are so hungry after the past two years that they are almost helping the purchasing agents demand special concessions.

"All the boys are hammering me to meet this competition but I'm a bit leary as to doing it on my own hook. I know how you feel about price cutting. Sort of absorbed it at the breakfast table along with the buckwheats and sausages, and I'm sitting tight till I get your anwser to this S. O. S. I just feel it in my bones that I ought to say NO, but I'm new in the game and I want an alibi; also some darn good reasons to fire at 'em when they holler. I hate to bust into your fishing but perhaps you're catching too many anyhow.

Your troublous Tom."

Not such a bad letter for a youngster. Shows promise of following in the old man's footsteps all right. And perhaps he wasn't proud of his Dad's come-back.

"Isn't that just like Dad" he said with a grin as he handed it to me to read. Here it is:

"Dear Tom:

"Your letter came just in time to save me from spending another perfectly good day playing with that little coffee mill on my fish pole. Haven't caught a darn thing yet and I'm glad of an excuse to stay at the hotel and kid myself into thinking its business.

"Yes I've been through that sort of thing before Tom, and its good experience because it takes nerve to know how to sit tight when the other fellow is losing his sense of proportion. Now, when those salesmen ask you to cut prices to meet that kind of competition, just ask them whether they are really salesmen or just order takers. Ask 'em what is the us of maintaining an expensive, high-class sales force, spending good money for railroad fares and living at good hotels, when we can give our motors away just as well by mail, for a two-cent stamp. It doesn't take much of a purchasing agent to play one weak salesman against another when you show him that you are just aching to give him a lower price than you quoted.

"This seems to be one of the times when a price list doesn't mean anything but the salesman's upper limit. And that usually means that some of the price cutters are sure to fill their shops up with orders at a low price, which will prevent them taking orders when the market stiffens up so the prices are right. Of course it's a fine thing to keep a shop running full time, but its something of a shock to find out, when deliveries are made, that you haven't made enough to pay the overhead. And I've seen a lot of them do just that very thing at a time when the market was on the point of turning so that a fair price could be had at once.

"You know how I feel about unreasonable profits, Tom. And unreasonably low prices that leave no profits, or a loss, are just as bad, or worse. As long as you are busy the men think you are making money and they have a right to. You can't blame them for being skeptical when you tell them you took a job so low there was nothing in it, even if it's true. They very naturally think you are putting a job up on them, and even showing them the books don't help much, because they know as well as anyone that while figures won't lie, liars will figure, and they aren't expert accountants by a long ways.

"There always seems to be a lot of business men who think that a big volume of business has got to show a profit even if the price is below cost. The final answer in all such arguments is the bank account, and I'll let you imagine my modest blush when I remind you that ours stacks up mighty well with any of them in our line.

"Don't try to meet their prices. We build a good motor and sell it at a fair price, and the trade knows it. Don't worry about the order the other fellow gets when you know it is below cost or so near it that only a miracle can keep it from being a loss. The birds who pick up this kind of business will get a beautiful jolt in the bank account when the contract is filled. In the meantime we will have booked a nice little wad of orders at the right price. The more of the undesirable orders the price cutters tuck away on their order books, the more chance we have of getting the real orders when the right people get ready to place them. Let 'em get filled up good and proper with low priced orders before they wake up.

"I know it isn't pleasant to see idle machines in the shop and no one likes to see them busy better than I do. But the thing to do right now is to get ready to do business in the most economical way. Have the production men go over the various operations and see where we can cut costs. We've got a good machine equipment and we know that our methods compare favorably with those of the rest of them. So when they cut prices way below ours we know darned well there's no money in it.

"The worst feature of this price cutting game is that it makes such infernal liars out of otherwise fairly respectable business men. I know men who will swear on a stack of bibles that they never cut a price and yet I also know that they take orders away below what is printed on their lists. I've seen the contracts. I've a lot more admiration for the Noname people, even if they are not supposed to be high-grade business men. They admit they cut prices when they need business badly and trust to luck, and ignorance on the part of some purchasing agent, to make it up on the next order.

"There are times when it is cheaper to lose a little money on an order than to shut down and lose your organization. But that isn't the case now. And you remember that I've always told you, that a business has got to make money pretty regularly or it might as well nail up the door and send a messenger for the sheriff. Don't get panicky and do the fool thing just because a lot of our competitors are losing their heads at the sight of real orders. We're just about breaking even and its a heap better to do that than to sink a lot of good money, just to prevent some one else from getting the order. Better let him do the losing if he's so darned anxious to make a show of being busy.

"This is the time for the boys on the road to prove whether they are really salesmen or only animated and expensive order blanks. It's a good time to find out the men we want to count on as a part of our permanent staff. Keep your nerve Tommy, my boy, I'm going back to my alleged fishing.

Affectionately,

Dad."

According to my notion this kind of advice applies to a lot more than builders of motors for buzz wagons and such. I've run into some of the price cutting myself, even along machine tool lines, and it sure does seem as though it was a bit out of place right now. It's a heap better to have a low price and stick to it, than to have a price list to be varied according to circumstances.

Modern Methods of Making Shovels Of Molybdenum Steel

By FRED H. COLVIN
Editor, *American Machinist*

Handling the sheets—Welding and heat-treating—Special tools and fixtures for shaping and holding—Preparing the handles and assembling into completed shovels

THE USE OF molybdenum alloy itself is so new in any field that it naturally follows that its use in shovels will only be found in plants that are alive to possible improvements in their product. The Wood Shovel and Tool Company, Piqua, Ohio, was prompt to recognize the value of the new alloy in making a better and longer lived shovel and has successfully overcome the difficulties that presented themselves in the welding of the straps to the blade, as well as securing a heat-treatment that would give a uniform hardness to the wearing portion of the blade. The plant itself is interesting as an example of modern construction and it has the unusual advantage of being located opposite a beautiful park which was planned by the founder of the business. This park makes a most unusual outlook from the windows of the office and also from that portion of the shopt which is on the same street as the office.

The illustrations that follow tell the story of the methods used in manufacturing the shovels so that comparatively little text is necessary. They also show the number of operations required in making a modern shovel as well as the number of pieces required in the making. There are 18 operations on the blade, not counting the inspections which take place at various stages. The operations are shown by the numbers in Fig. 1, as follows:

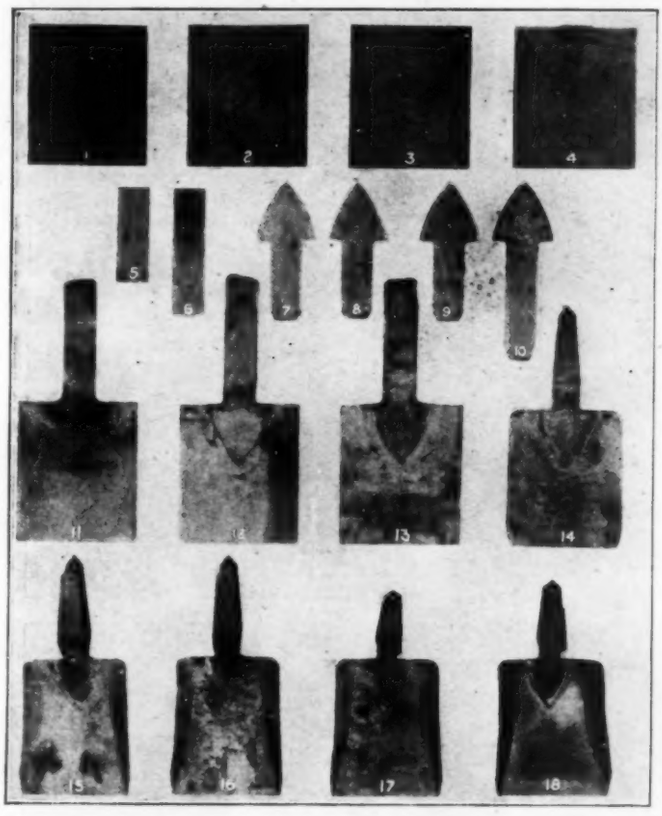


FIG. 1—OPERATIONS ON BLADE

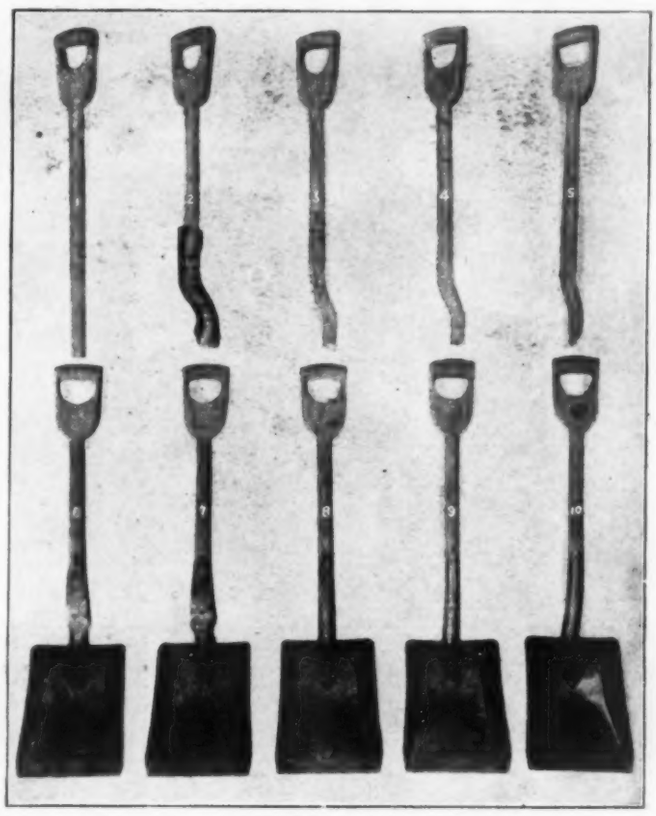
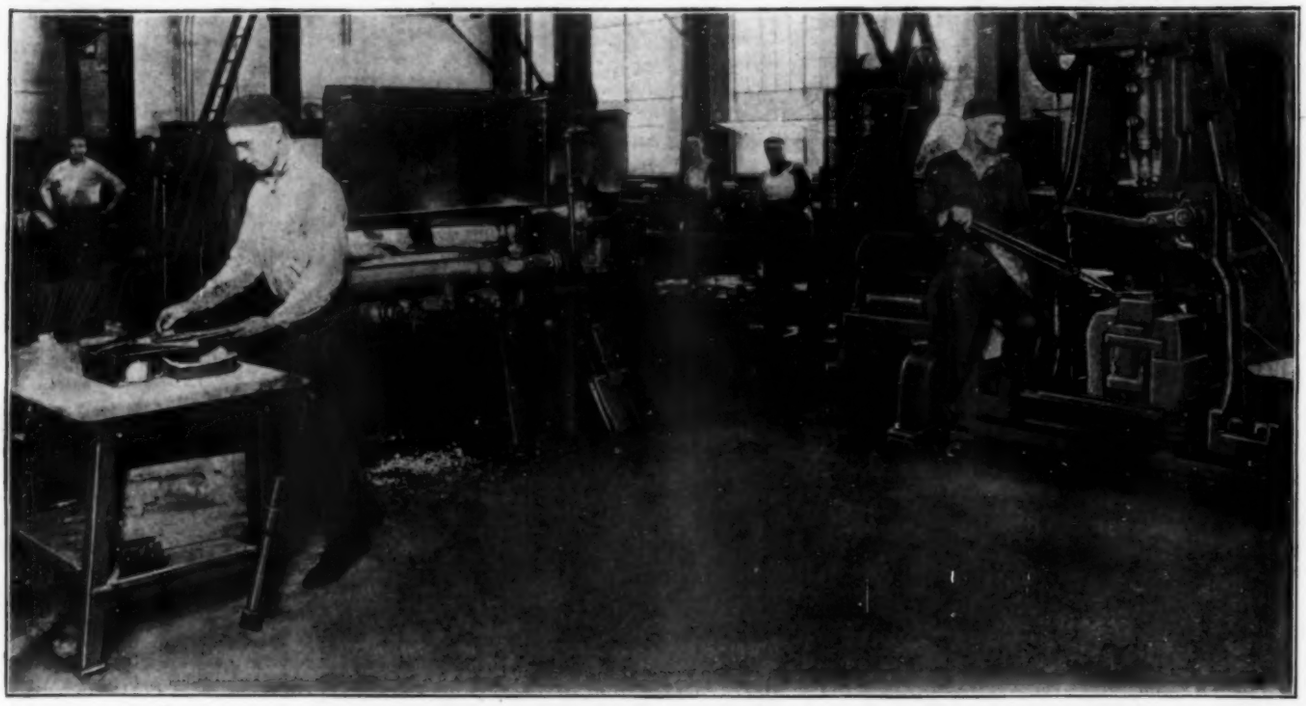


FIG. 2—OPERATIONS ON HANDLES

1 Blade cut from sheet
2 Hole punched for rivet to hold front strap in welding
3 Heat-number of steel mill stamped in blade
4 Blade scarfed for welding back strap
5 Back strap cut from sheet
6 Back strap rolled out thin to shape to handle
7 Front strap blanked out from sheet



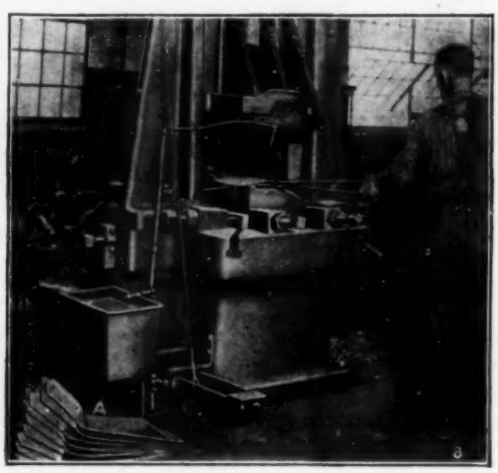


FIG. 3—CHAMFERING FRONT STRAPS FOR WELDING. FIG. 4—WELDING STRAPS. FIG. 5—TESTING THE WELDS. FIG. 6—SHAPING THE SOCKETS. FIG. 7—HAMMERING OUT BUCKLES. FIG. 8—SHAPING HOLLOW BACK SCOOPS

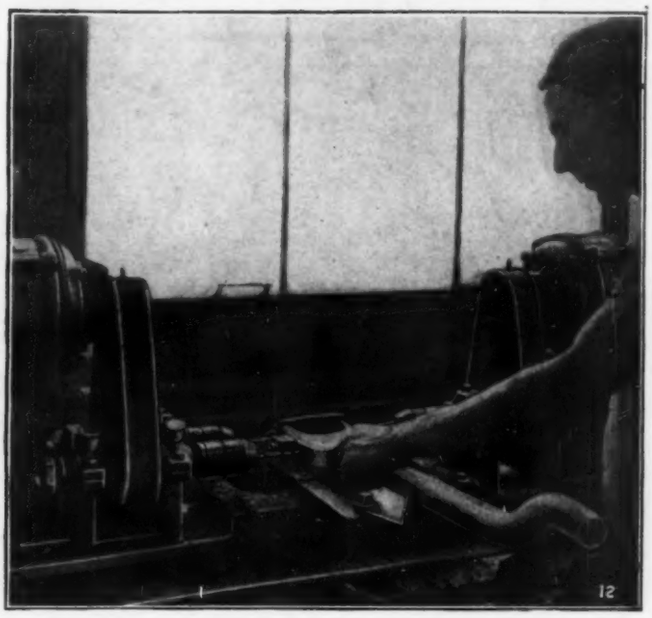
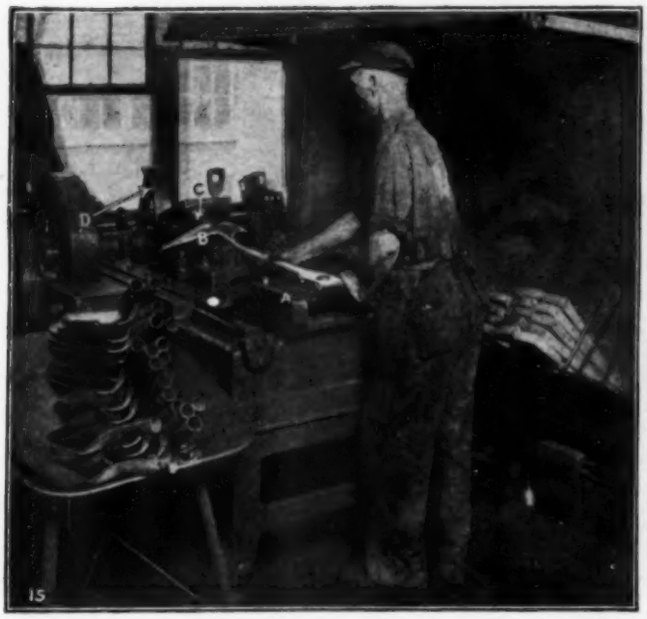
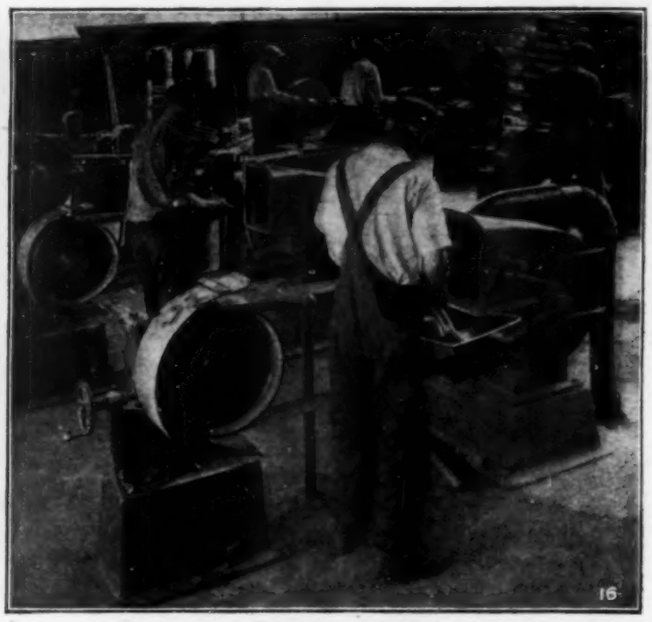
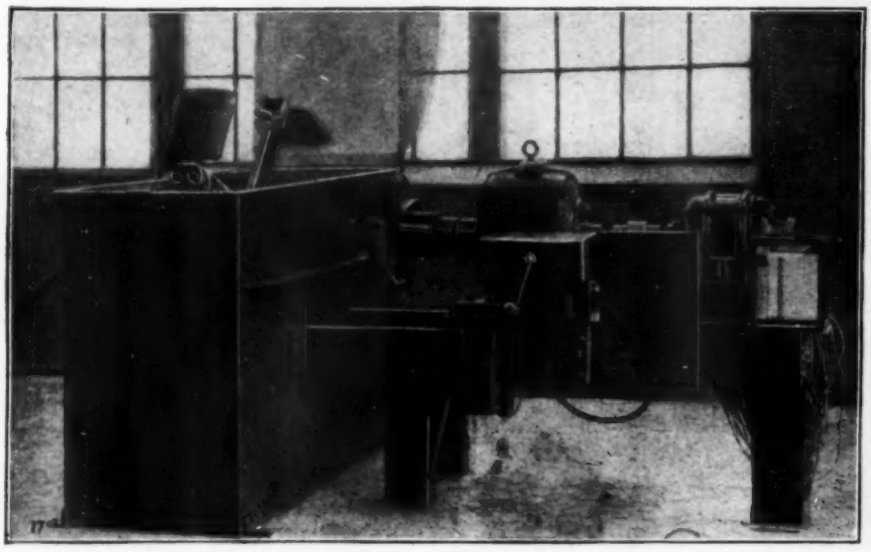


FIG. 9—POLISHING SHOVELS WITHOUT GOGGLES. FIG. 10—STACKING SHOVEL HANDLES. FIG. 11—FORMING HANDLES TO FIT SOCKETS. FIG. 12—DRILLING THE HANDLES. FIG. 13—ROLLING STRAPS AROUND HANDLES. FIG. 14—INSPECTING SHAPE OF HANDLE AND SHOVEL







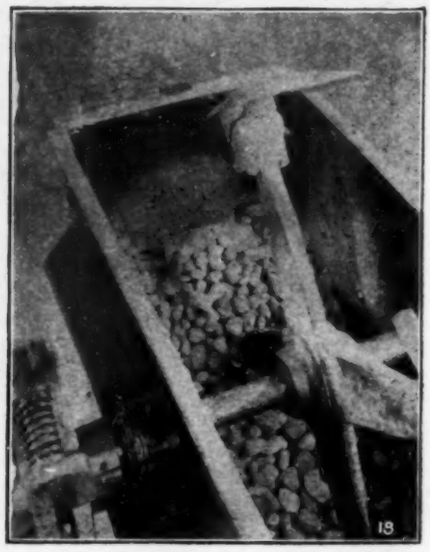


FIG. 15—PUTTING HANDLES IN SOCKETS. FIG. 16—POLISHING HANDLES. FIG. 17—MACHINE FOR TESTING STRENGTH AND DURABILITY. FIG. 18—STONES USED FOR TESTING. FIG. 19—SEVERE BENDING TEST FOR SPADE. FIG. 20—BENDING THE OTHER WAY. FIG. 21—SPRINGING BACK WITHOUT SET

8 Edge of front strap chamfered to aid in welding
9 Hole punched in front strap for riveting to blade
10 Front strap rolled out thin to shape to handle
11 Back strap welded to blade
12 Front strap riveted to blade
13 Front strap welded to blade
14 Blade and straps trimmed
15 Blade shaped and holes punched in straps for riveting to handle
16 Straps stamped with trade mark
17 Socket turned, or rounded, to shape of handle
18 Blade completed ready for handling. Has bad buckles hammered out, edges ground, been heat-treated, Brinnel tested, hammer tested for toughness and wire brushed

The Handles

The handles have only ten stages although one stage, the polishing, requires four operations. The operations are shown in Fig. 2.

1 Handle after being graded
2 Handle still in bending form
3 Holes drilled in handle for riveting
4 Handle riveted
5 Handle chucked and trimmed to fit socket in blade
6 Handle inserted in blade and strap closed
7 Holes drilled through and handle riveted
8 Straps rolled to fit handle, sockets closed and edges filed
9 Straps and handles polished (4 operations)
10 Blade dipped, handle waxed, branded and labelled

With the list of operations in mind the captions under the various illustrations will be self explanatory in most cases. Beveling the edges of the front strap, Fig. 3, is a continuous operation, the revolving table being loaded while the blade at the right is being trimmed. The beveled edge is in reality a scarf that makes the welding of the strap to the blade more satisfactory in every way. The welding is done under the power hammer shown in Fig. 4, and although molybdenum alloy is supposed to be very difficult to weld, a flux has been discovered which enables the weld to be guaranteed. The large pipe in front of the furnace is perforated on top and a constant curtain of cold air is being forced up between the men and the heat of the furnace opening. This has proved a very satisfactory method of heat protection.

The socket for the handle is formed by holding the blade in the power hammer and driving the mandrel *A* between the two heated straps, as shown in Fig. 6. The buckling which naturally takes place is removed by the small Dienelt and Eisenhardt hammer to be seen in Fig. 7. This hammer is crank driven and the head is suspended by straps.

Another type of shovel is shown in the lower left-hand corner of Fig. 8, the sockets for the handles being integral with the blade. The hammer in the center shapes the blades and puts the sockets into the shape to be seen at *A*. The sockets are then reheated and closed on another machine.

A Modern Polishing Room

A corner of the polishing room is shown in Fig. 9. The ball-bearing polishing stands are equipped with individual motors and each stand is connected to a powerful exhaust system which draws the stream of sparks and grinding dust down the intake, as can be seen in the foreground. This system is so efficient that the polishers have found it perfectly safe to abandon the use of goggles which are very hot and disagreeable, especially in warm weather. The use of the operator's knee for holding the shovel against the wheel is clearly shown, as is the knee pad which is worn for protection. Care is taken to prevent overheating and drawing the temper of the blade in this operation.

The compact method of stacking handles is shown in Fig. 10 ten handles being tied together by running two more handles through the eyes, making a dozen in a unit which can be readily stacked and counted.

The handles are shaped by steaming in the tank at the left in Fig. 11, then clamping them in a vise at *A* and forcing the softened ends into the iron form at *B* in a sort of bull-dozer. Half of one of the forms is shown at *C*. Fig. 12 shows a special double-head drill for handle rivets, each head having its own motor. The straps are rolled to fit the handles in two passes of the rolls to be seen in Fig. 13. The rolls are cam shaped, allowing the shovel to be released after the straps have been closed.

Handles are forced into solid-socket shovels in another bull-dozer shown in Fig. 15. The spade-handle is held as at *A*, while the blade *B* is held in the ram at the wedge *C*. The cam *D* drives the ram, carrying the blade back on the handle.

The testing machine for shovels is very ingenious, and has been patented. The steel box, Fig. 17, is partially filled with red granite rocks through which four shovel blades revolve at about 14 r.p.m. The spring coupling acts as a shock absorber similar to the effect of a man pushing the blade into gravel until it is loaded. Between the coupling and the 3-hp. motor is a Foote reducing gear. A recording watt-meter keeps an actual record of the work done and the effect on the shovels of various kinds is readily noted.

Any user of steels will be interested in the tests shown in Figs. 19 to 21. It is hardly believable that a spade can be clamped in the vise, bent forward as in Fig 19 and then bent backward as in Fig. 20 and come back to normal as in Fig. 21. As an example both of material and of tempering, it has few equals. If molybdenum steels can be made to do this, we need more of them in other lines of work.

A noticeable feature of the plant is the evidence of personal contact between workers and executives. While such contacts are perhaps more easily accomplished in small communities than in large cities, there must be the desire on the part of the executives to secure the kind of co-operation which comes only in this way, before any definite results can be accomplished. Whatever the method, the results seem to be self evident all through the plant.

Drill Steel Investigations

It is proposed to continue at the Mississippi Valley Experiment Station of the Bureau of Mines, Rolla, Mo., during the coming year the study of means whereby better service may be had from mine drill steels. Early in 1922 a survey was made of the present drill steel situation in the various mining districts throughout the country and from the data obtained a plan of attack on the problem of improvement is being devised. This will take into consideration the effect of forging and heat treating variables such as furnace atmosphere, temperature of the steel and quenching methods, and also furnace design with a view to devising a practical method of getting better temperature control. A survey, similar to that made of the mine drill, is to be made of oil well drilling for the purpose of determining what steps may be taken to improve churn drilling.

Asiatic Markets for Industrial Machinery

AN EXCELLENT report on machinery markets in the Far East, written two years ago by Walter H. Rastall, then trade commissioner for the Department of Commerce, has just been issued by the Government Printing Office. Mr. Rastall, who is now at the head of the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, has had much experience in the region on which he reports, having sold machinery in Japan from 1904 to 1911. The basis of the report is an extended trip begun just after the armistice and lasting two years.

The report opens with general remarks on the position of Asia in America's machinery trade. Mr. Rastall says, "The 'unchanging East' is changing rapidly and profoundly. During the last three years Asia has absorbed as much American machinery as it would have taken in five decades if measured by the standards of 1915. And this is a matter of the most profound significance. For a long time great efforts have been made to modernize Asia. Missionary and merchant, teacher and diplomat have worked for progress. Practically every European that visits Asia joins in the demand for reform, and it has been so since the days of Marco Polo; but suddenly, within four years, these markets absorbed some $242,000,000 worth of American industrial machinery. One concludes that, in the confusion of other great events, the significance of this is unnoticed. The potentialities of such a volume of machinery in the hands of the millions of Asia is tremendous, and each of these units is the best possible advertisement and will encourage the installation of more.

"Also the market is not as it was in 1911. The pioneer work that involved so much patient toil in former years is now showing results, and the whole continent from Yokohama to Bombay wants to be industrialized. The sales problem there is no longer so difficult or expensive as it was before the war upset the world in 1914, and foreign-sales managers in establishing their policies will do well to consider the cities of Asia as new markets to be restudied in all details. Even the old familiar problems that one had long thought solved, such as packing or advertising are up again for consideration and need careful thought, as the conditions have changed and that which was satisfactory in 1913 does not meet the conditions of the present day.

American Engineering Supremacy Recognized in Asia

"It is the writer's impression that the people of Asia, in all of the countries, appreciate the value of modern industrialism and realize that by the use of machinery they will be able to raise their standard of living. They desire this above almost anything else. They know well the difference between conditions in their countries and those in the industrialized west, and they are very ambitious to better their own conditions. To a greater or less degree they appreciate the superiority of American engineering and American industrial machinery, and whenever money is plentiful they can be relied on to buy. Each year it is becoming easier to promote new enterprises; the existing operators grow in experience and knowledge. The field is a most promising one.

"On the whole it appears that we can expect to export to Asia during the next few years an average of about $40,000,000 or $50,000,000 worth of industrial machinery per year, and foreign-sales managers would presumably be justified in developing their organizations to correspond with this basis. It will be noted that this is about ten times the volume of the trade in 1915. Allowance and preparation should also be made for a rapidly increasing volume during the following years.

English as Language of Trade

"The markets of Asia have important attractions for the American exporter of machinery. In addition to the large volume and rapid rate of development of the trade transacted there, the simplicity of the language problem is of great assistance. In Europe this problem is very serious, and many tongues are involved. In South America it involves the use of Spanish and Portuguese. In Asia the language of trade is English. One may travel from Bombay to Yokohama and English is the language used in the offices of nearly all of the firms engaged in the machinery trade. Practically every buyer intrusted with authority to purchase machinery knows English well. Even the Japanese and Dutch engineering firms who operate their own business in their own language have plenty of men who are qualified engineers with a fluent knowledge of English. They do not ordinarily expect to be addressed in any other language. Catalogs and advertising matter as used in America quite commonly meet the requirements of the machinery trade in Asia. Similarly one seldom finds it necessary to use the metric system of weights and measures. Difficulties of translation and correspondence will not ordinarily appear."

The standing of American machinery in world markets is then taken up and after that effective means of promoting machinery sales in Asia. Valuable information and advice on packing, advertising and the types of machinery suitable for Asia follow. The general section ends with remarks on miscellaneous factors affecting sales policy.

Then come chapters on the individual problems incident to marketing machinery in the various countries of the Far East. India comes first and is followed by Ceylon, the Malay Peninsula, the Netherlands East Indies, the Philippines, China and Japan.

It is impossible to do justice to Mr. Rastall's report in the space available here. The original should be in the hands of every machinery builder and sales manager. The great pity is that the valuable information contained in it should have been withheld from those most interested by the aggravatingly slow processes of Washington bureaucracy.

Some Grinding Operations on the Brown & Sharpe Milling Machine Spindle —Erratum

In the article "Some Grinding Operations on the Brown & Sharpe Milling Machine Spindle," which appeared on page 173, Vol. 58, and following pages of the *American Machinist*, an error occurs in the last paragraph of the first column on page 175, where it is stated that the external grinding is done upon a No. 4 Brown & Sharpe universal grinding machine. This operation as well as the finishing operation mentioned later in the article, is performed upon a No. 14 Brown & Sharpe plain grinding machine.

Table for Use in Milling Cams for B. & S. Automatic Screw Machines

BY ERNEST C. ALLEN

Improvement in former tables—Theoretical rise for B. & S. cams not a spiral—Errors in steep rises—Use of table

THE ACCOMPANYING table is for finding the angles used in milling Brown & Sharpe automatic screw machine cams. This table has, I believe, some advantages over the tables in current use. It is designed to reduce the number of gear changes to a minimum, only eight leads being given. Leads above six inches are omitted for the reason that the theoretically perfect rise of a Brown & Sharpe screw machine cam is not a spiral and with steep rises this difference becomes so pronounced that the geometrical error far exceeds any errors usual to working the rise by hand, and the hand work is probably the cheapest.

The operation of the table will be largely self-evident. The column at the left gives the cam rise for a complete revolution of the cam or the rise of lobe $\times$ 100 in. $\div$ number of hundredths in lobe. For example, we have a lobe covering eight hundredths and having a rise of 0.375 in. Therefore $\frac{0.375 \times 100}{8} = 4.6875$ in., or the

Angle Between Arbor and Table

Rise in a Comp. Rev. of Cam.	Lead of Mach. 0.670 In.	Lead of Mach. 1.050 In.	Lead of Mach. 1.500 In.	Lead of Mach. 2.000 In.	Lead of Mach. 3.000 In.	Lead of Mach. 4.000 In.	Lead of Mach. 5.000 In.	Lead of Mach. 6.000 In.
	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.
0.005	0–26							
0.010	0–51							
0.015	1–17							
0.020	1–43							
0.025	2–08							
0.030	2–34							
0.035	3–00							
0.040	3–25							
0.045	3–51							
0.050	4–17							
0.055	4–43							
0.060	5–08							
0.065	5–34							
0.070	6–00							
0.075	6–26							
0.080	6–51							
0.085	7–17							
0.090	7–43							
0.095	8–09							
0.100	8–35							
0.105	9–01							
0.110	9–27							
0.115	9–53							
0.120	10–19							
0.125	10–45							
0.130	11–11							
0.135	11–38							
0.140	12–04							
0.145	12–30							
0.150	12–56							
0.155	13–23							
0.160	13–49							
0.165	14–15							
0.170	14–42							
0.175	15–08							
0.180	15–35							
0.185	16–02							
0.190	16–28							
0.195	16–58							
0.200	17–22							
0.205	17–49							
0.210	18–16							
0.215	18–43							
0.220	19–10							
0.225	19–37							
0.230	20–05							
0.235	20–32							
0.240	20–59							
0.245	21–27							
0.250	21–55							
0.255	22–22							
0.260	22–50	14–20						
0.265	23–18	14–37						
0.270	23–46	14–54						
0.275	24–14	15–11						

Angle Between Arbor and Table

Rise of a Comp. Rev. of Cam.	Lead of Mach. 0.670 In.	Lead of Mach. 1.030 In.	Lead of Mach. 1.500 In.	Lead of Mach. 2.000 In.	Lead of Mach. 3.000 In.	Lead of Mach. 4.000 In.	Lead of Mach. 5.000 In.	Lead of Mach. 6.000 In.
	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.	Degs. Min.
0.280	24–42	15–28						
0.285	25–10	15–45						
0.290	25–39	16–02						
0.295	26–07	16–19						
0.300	26–36	16–36						
0.305	27–05	16–53						
0.310	27–34	17–10						
0.315	28–03	17–27						
0.320	28–32	17–45						
0.325	29–01	18–02						
0.330	29–30	18–19						
0.335	30–00	18–36						
0.340	30–30	18–54						
0.345	30–59	19–11						
0.350	31–30	19–28						
0.355	32–00	19–46						
0.360	32–30	20–04						
0.365	33–01	20–21						
0.370	33–31	20–38						
0.375	34–02	20–55						
0.380	34–33	21–13						
0.385	35–04	21–31						
0.390	35–36	21–48						
0.395	36–07	22–06						
0.400	36–39	22–24						
0.405	37–12	22–41						
0.410	37–44	22–59						
0.415	38–16	23–17						
0.420	38–49	23–35						
0.425	39–22	23–53						
0.430	39–55	24–11						
0.435	40–29	24–28						
0.440	41–03	24–46						
0.445	41–37	25–05						
0.450	42–12	25–23						
0.455	42–47	25–41						
0.460	43–22	25–59						
0.465	43–57	26–17						
0.470	44–32	26–35						
0.475	45–09	26–54						
0.480	45–46	27–12						
0.485	46–23	27–31						
0.490	47–00	27–49						
0.495	47–38	28–07						
0.500	48–16	28–26	19–28					
0.505	48–55	28–45	19–40					
0.510	49–34	29–04	19–53					
0.515	50–14	29–23	20–05					
0.520	50–55	29–41	20–17					
0.525	51–35	30–00	20–29					
0.530	52–27	30–19	20–41					
0.535	52–59	30–39	20–54					
0.540	53–43	30–57	21–06					
0.545	54–26	31–16	21–18					
0.550	55–11	31–35	21–31					

rise per complete revolution. The nearest rise to 4.6875 in. occurring in the table is 4.750 in. This will usually be near enough but if for any reason greater accuracy is required, interpolation may be resorted to.

In finding the angles for a set of cams one should first find the complete rises of all the lobes. It is then a simple matter to assign as many of these rises to any one lead as come within the range of that lead, spreading the whole over as few leads as possible. The use of this table has saved the author much time and trouble.

Angle Between Arbor and Table

Rise in a Comp. Rev. of Cam.	Lead of Mach. 0.670 In.		Lead of Mach. 1.050 In.		Lead of Mach. 1.500 In.		Lead of Mach. 2.000 In.		Lead of Mach. 3.000 In.		Lead of Mach. 4.000 In.		Lead of Mach. 5.000 In.		Lead of Mach. 6.000 In.	
	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.
0.555	55	50	31	55	21	43										
0.560	56	42	32	14	21	55										
0.565	57	30	32	33	22	08										
0.570	58	18	32	53	22	20										
0.575	59	07	33	12	22	33										
0.580	59	58	33	32	22	45										
0.585	60	50	33	52	22	57										
0.590	61	43	34	12	23	10										
0.595	62	38	34	31	23	22										
0.600	63	35	34	51	23	35	17	27								
0.605	64	34	35	11	23	47	17	37								
0.610	65	33	35	31	24	00	17	46								
0.615	66	41	35	51	24	13	17	54								
0.620	67	54	36	12	24	25	18	04								
0.625	68	53	36	31	24	37	18	13								
0.630	70	06	36	52	24	50	18	22								
0.635	71	24	37	13	25	03	18	31								
0.640	72	48	37	33	25	15	18	40								
0.645	74	17	37	55	25	28	18	49								
0.650	75	58	38	15	25	40	18	58								
0.655	77	51	38	36	25	53	19	07								
0.660	80	06	38	57	26	06	19	16								
0.665	83	00	39	18	26	19	19	25								
0.670	90	00	39	39	26	32	19	34								
0.675			40	00	26	45	19	43								
0.680			40	22	26	57	19	53								
0.685			40	43	27	10	20	02								
0.690			41	05	27	23	20	11								
0.695			41	27	27	36	20	20								
0.700			41	49	27	49	20	29								
0.705			42	11	28	02	20	38								
0.710			42	33	28	15	20	48								
0.715			42	55	28	27	20	57								
0.720			43	17	28	40	20	06								
0.725			43	40	28	53	21	15								
0.730			44	03	29	07	21	24								
0.735			44	26	29	21	21	34								
0.740			44	49	29	34	21	43								
0.745			45	12	29	47	21	52								
0.750			45	35	30	00	22	02								
0.755			45	58	30	13	22	11								
0.760			46	22	30	27	22	20								
0.765			46	46	30	40	22	29								
0.770			47	10	30	53	22	39								
0.775			47	34	31	06	22	48								
0.780			47	59	31	20	22	57								
0.785			48	23	31	34	23	07								
0.790			48	48	31	47	23	16								
0.795			49	13	32	00	23	25								
0.800			49	38	32	14	23	35								
0.805			50	03	32	27	23	44								
0.810			50	29	32	41	23	54								
0.815			50	55	32	55	24	03								
0.820			51	21	33	08	24	12								
0.825			51	47	33	22	24	22								
0.830			52	14	33	36	24	31								
0.835			52	41	33	49	24	41								
0.840			53	08	34	03	24	50								
0.845			53	36	34	17	25	00								
0.850			54	03	34	31	25	09								
0.855			54	31	34	45	25	19								
0.860			55	00	34	59	25	28								
0.865			55	28	35	13	25	38								
0.870			55	57	35	27	25	47								
0.875			56	26	35	41	25	57								
0.880			56	56	35	55	26	06								
0.885			57	27	36	10	26	16								
0.890			57	58	36	24	26	25								
0.895			58	29	36	38	26	35								
0.900			59	00	36	52	26	45								
0.905			59	32	37	07	26	54								
0.910			60	06	37	21	27	04								
0.915			60	38	37	35	27	13								
0.920			61	11	37	50	27	23								
0.925			61	46	38	04	27	33								
0.930			62	20	38	19	27	43								
0.935			62	57	38	33	27	52								
0.940			63	33	38	48	28	02								
0.945			64	11	39	03	28	12								
0.950			64	49	39	18	28	22								
0.955			65	26	39	33	28	31								
0.960			66	06	39	47	28	41								
0.965			66	48	40	02	28	51								
0.970			67	30	40	17	29	01								
0.975			68	13	40	32	29	11								
0.980			68	54	40	47	29	20								
0.985			69	45	41	01	29	30								
0.990			70	32	41	17	29	40								
0.995			71	23	41	33	29	50								
1.000			72	15	41	49	30	00	19	28						
1.010			74	08	42	20	30	20	19	40						
1.020			76	16	42	50	30	40	19	53						
1.030			78	48	43	23	31	00	20	05						
1.040			82	05	43	54	31	20	20	17						

Angle Between Arbor and Table

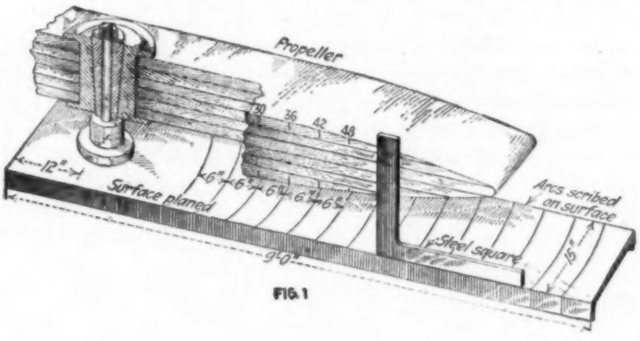
Rise in a Comp. Rev. of Cam.	Lead of Mach. 0.670 In.		Lead of Mach. 1.050 In.		Lead of Mach. 1.500 In.		Lead of Mach. 2.000 In.		Lead of Mach. 3.000 In.		Lead of Mach. 4.000 In.		Lead of Mach. 5.000 In.		Lead of Mach. 6.000 In.	
	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.	Degs.	Min.
1.050			90	00	44	27	31	40	20	29						
1.060					44	57	32	00	20	41						
1.070					45	30	32	20	20	54						
1.080					46	04	32	41	21	06						
1.090					46	36	33	01	21	18						
1.100					47	10	33	22	21	30						
1.110					47	44	33	43	21	43						
1.120					48	18	34	03	21	55						
1.130					48	53	34	24	22	07						
1.140					49	28	34	45	22	20						
1.150					50	03	35	06	22	33						
1.160					50	39	35	27	22	45						
1.170					51	16	35	48	22	58						
1.180					51	53	36	09	23	10						
1.190					52	30	36	31	23	22						
1.200					53	08	36	52	23	35						
1.210					53	46	37	14	23	47						
1.220					54	25	37	35	23	59						
1.230					55	05	37	57	24	12						
1.240					55	45	38	19	24	25						
1.250					56	26	38	41	24	37	18	13				
1.260					57	08	39	03	24	50	18	22				
1.270					57	51	39	25	25	03	18	31				
1.280					58	34	39	48	25	15	18	40				
1.290					59	19	40	09	25	28	18	49				
1.300					60	04	40	32	25	41	18	58				
1.310					60	51	40	55	25	53	19	07				
1.320					61	38	41	18	26	06	19	16				
1.330					62	28	41	41	26	19	19	25				
1.340					63	17	42	04	26	32	19	34				
1.350					64	10	42	27	26	45	19	43				
1.360					65	03	42	50	26	57	19	53				
1.370					65	59	43	14	27	10	20	02				
1.380					66	56	43	38	27	23	20	11				
1.390					67	55	44	02	27	36	20	20				
1.400					68	49	44	25	27	49	20	29				
1.410					70	03	44	50	28	02	20	39				
1.420					71	12	45	14	28	15	20	48				
1.430					72	26	45	39	28	28	20	57				
1.440					73	45	46	03	28	41	21	06				
1.450					75	09	46	28	28	54	21	15				
1.460					76	45	46	53	29	07	21	24				
1.470					78	31	47	18	29	20	21	34				
1.480					80	38	47	44	29	33	21	43				
1.490					83	23	48	10	29	46	21	52				
1.500					90	00	48	36	30	00	22	02				
1.525							49	41	30	32	22	24				
1.550							50	48	31	06	22	48				
1.575							51	57	31	40	23	11				
1.600							53	09	32	14	23	35	18	40		
1.625							54	23	32	48	23	58	18	58		
1.650							55	39	33	22	24	21	19	16		
1.675							56	52	33	56	24	45	19	34		
1.700							58	12	34	31	25	09	19	52		
1.725							59	36	35	06	25	33	20	11		
1.750							61	03	35	41	25	57	20	29		
1.775							62	34	36	16	26	21	20	48		
1.800							64	10	36	52	26	45	21	06		
1.825							65	51	37	28	27	09	21	24		
1.850							67	40	38	04	27	33	21	43		
1.875							69	38	38	41	27	57	22	02		
1.900							71	49	39	16	28	21	22	20		
1.925							74	16	39	55	28	46	22	39		
1.950							77	10	40	33	29	10	22	57		
1.975							80	56	41	11	29	35	23	16		
2.000							90	00	41	49	30	00	23	35	19	28
2.100									44	26	31	40	24	50	20	28
2.200									47	10	33	22	26	06	21	30
2.300									50	03	35	06	27	23	22	32
2.400									53	08	36	52	28	41	23	35
2.500									56	24	38	41	30	00	24	37
2.600									60	04	40	32	31	20	25	41
2.700									64	09	42	27	32	41	26	45
2.800									68	58	44	25	34	03	27	49
2.900									75	09	46	28	35	27	28	53
3.000									90	00	48	36	36	52	30	00
3.100											50	48	38	19	31	08
3.200											53	08	39	47	32	22
3.300											55	35	41	18	33	22
3.400											58	13	42	51	34	31
3.500											61	03	44	26	35	41
3.600											64	09	46	03	36	52
3.700											67	40	47	44	38	04
3.800											71	49	49	28	39	18
3.900											77	10	51	16	40	33
4.000											90	00	53	07	41	49
4.250													58	12	45	09
4.500													64	10	48	36
4.750													71	49	52	20
5.000													90	00	56	26
5.250															61	03
5.500															66	26
5.750															73	24
6.000															90	00

Repair Equipment Of Airplane and Seaplane Stations

By ARCHIBALD BLACK
Consulting Aeronautical Engineer

Types of equipment for the repair of airplanes, seaplanes, flying boats and their engines—Typical shop arrangement — Special items of equipment

THE EQUIPMENT provided at stations for the repair of airplanes, seaplanes, flying boats and their engines may be divided into the two general classes of "airplane repair" and "engine repair." As is also the case with the station maintenance and operating equipment, the repair equipment necessary will depend entirely upon the extent to which the station is used. Consequently, it is impossible to give any list which could be regarded as typical of the equipment for any station. Military and Naval stations are usually arranged and equipped more with regard to the possibility of very rapid expansion of the station activities rather than to immediate needs. On the other hand, and owing chiefly to lack of funds, civil stations are generally provided with less equipment than is really necessary. Thus a list of equipment of some typical Army or Navy station would be of no value whatsoever to those interested in civil stations. Both privately owned stations and municipal stations, provided for civil use, present practically the same conditions and this discussion is confined entirely to these latter classes as promising the greatest field of future development.



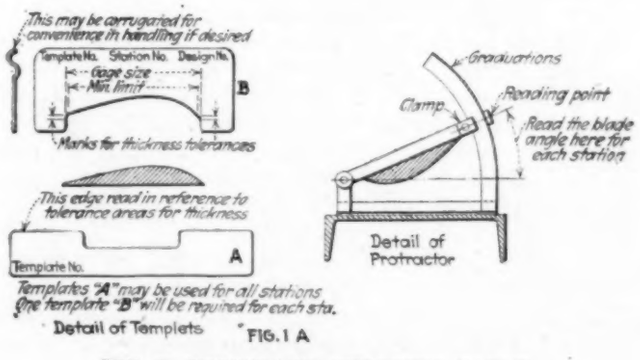


FIG. 1—PROPELLER CHECKING TABLE

A detailed list of all equipment falling within the two classes mentioned above is given here in Tables I and II. These tables are very complete and are not intended to represent the equipment necessary at every station. The need of each item would, of course, be determined by the class and amount of repair work anticipated and would vary for every station considered. As a matter of fact, many of the most completely equipped stations are not provided with some of the items included in each list but this is usually because much of the work is sent back to the airplane and engine factories.

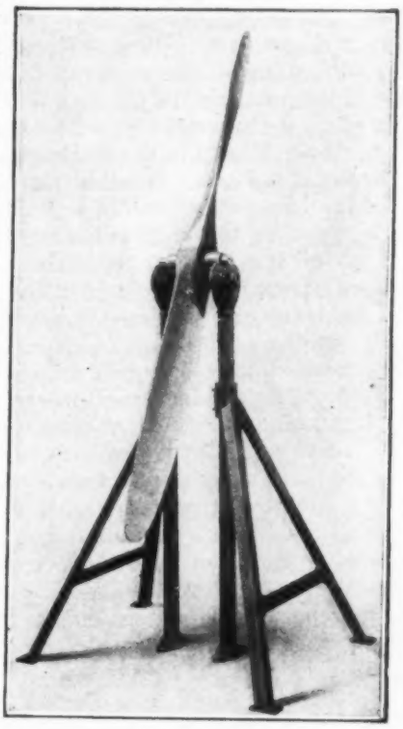


FIG. 2—PROPELLER BALANCING STAND

The limited amount of work, together with the still more limited funds available for the purchase of equipment, necessitates confining present stations to the very barest necessities, if not less. Quite often it is only by sending much of the work back to the factories that the major repairs can be made at all. This is, of course, not efficient, and as the use of the stations grows we may expect to see their equipment continually increased until practically every important station has repair shops approaching factory conditions in their equipment. So far as the airplane and hull end of the work is concerned, it is difficult to draw any hard and fast line between what is strictly factory equipment and what may be both station and factory equipment. The list given in Table I therefore overlaps somewhat into the factory class of equipment and, as given, would provide sufficiently for the entire reconstruction of

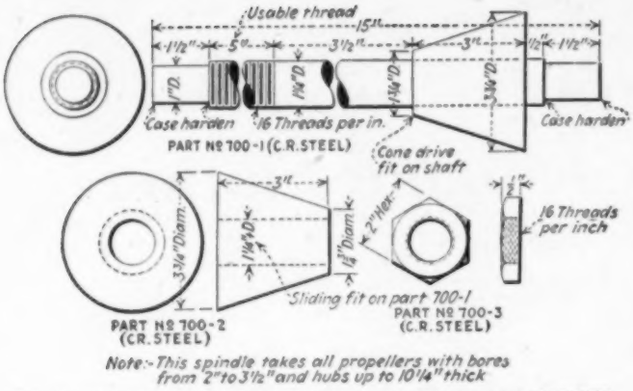


FIG. 3—UNIVERSAL PROPELLER BALANCING MANDREL

airplanes. As this will probably become the eventual condition, the table is not so much out of proportion here as first impression might suggest.

No matter how little any station may be used, a certain number of miscellaneous small tools will be required for the very minor repair and the adjustment work. Table III gives a complete list of the small tools which are kept on hand at all Air Mail Service fields for service purposes and this applies so well to general purposes that I present it here without any modifications. Many of the tools on this list need not be purchased by the station management as a first class mechanic hired for the work could be expected to carry possibly one third of the lesser items in his tool kit. If only one or two mechanics are to be kept at the station, the quantity of some items may be cut in half. For almost any ordinary case however, the list will apply just as it is given, being proportionateliy increased where over proportionately increased where over ployed all or most of the time.

Where no extensive repairs to airplanes are expected to be made, only one or two benches (somewhat of the type used by carpenters) with a carpenter's vise and a small machinist's vise on each, together with the essential small tools listed above will be the only equipment necessary for the work. As the importance of the repair work grows, either from the viewpoint of volume or thoroughness, the list of equipment necessary will also grow until it approaches the list of Table I. Most of the equipment on this list being standard, it is not necessary to discuss it in detail. There are, however, some specially designed items worthy of comment and description.

If propellers are to be built or any quantity of them are to be repaired, a checking table, balancing stand and balancing mandrels will be necessary. A very satisfactory type of checking table can be constructed as shown in Fig. 1 and at moderate cost. This type of table has been thoroughly tried out in several factories for the past few years and really costs little more than a makeshift device. It should be furnished with a checking protractor somewhat of the type shown in Fig. 1A. Two types of propeller balancing stands have been extensively used. In one type the propeller is mounted on a mandrel and laid on two parallel level tracks. If in balance it remains in place, while if out of balance it rolls along until the heavy end is down. In the second type, illustrated in Fig. 2, the propeller is mounted on a mandrel which turns on rollers as shown. This latter type is the most satisfactory an commercial stands of the type shown are marketed b the Mattison Machine Works of Rockford, Ill. To avoid the necessity of keeping several different sizes of mandrels on hand to fit each type of propeller, the writer and his associates designed a universal propeller balancing mandrel, shown in Fig. 3, which can be used for a very wide range of propeller sizes and with any type of balancing stand. Mandrels of this type can be made by any local machine shop or at the station if machine facilities are provided.

As regards woodworking machinery, a band saw, jointer, jig saw and spindle shaper or "variety machine" may be regarded as the most essential. If the machines are not to be subjected to heavy or continuous use and the funds are very limited, consideration might be given to the provision of some of the very lightweight combination machines which are marketed, for farm purposes, by mail order houses such as Sears, Roebuck and Company. For regular work, however, the heavyweight factory class of machinery is much to be preferred and should be used wherever circumstances will permit.

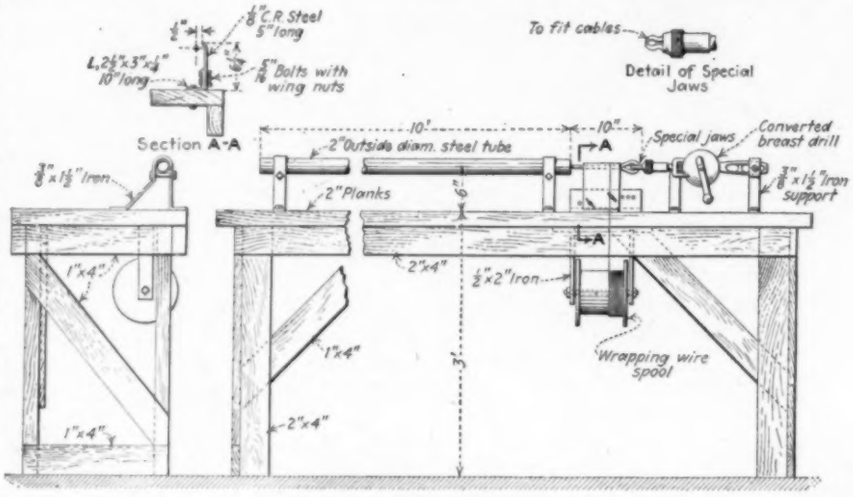


FIG. 4—CABLE TERMINAL WRAPPING BENCH

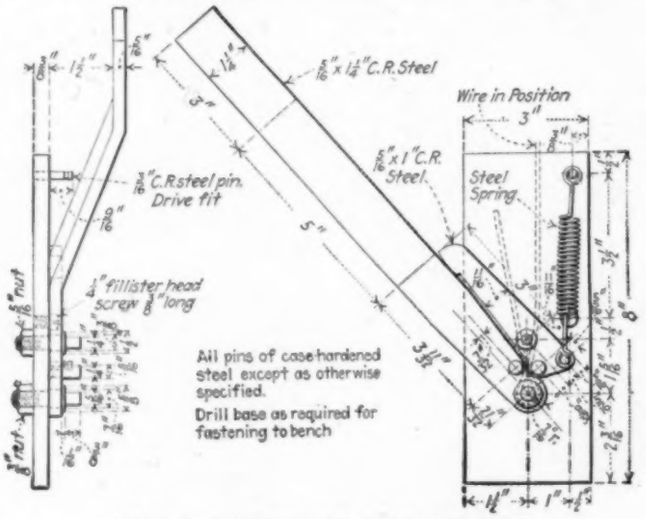


FIG. 5—HARD WIRE LOOP BENDER

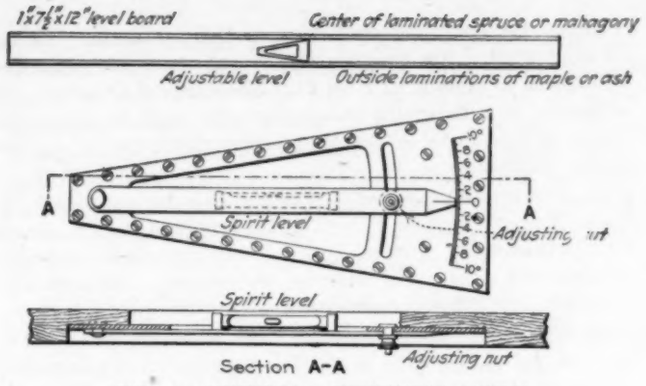


FIG. 6—DIHEDRAL CHECKING LEVEL

For the making up of wires and cables in fair quantities some small equipment will be necessary. A hard wire loop bender, cable terminal wrapping machine and a wire and cable proof-loading device should be provided. No apparatus of these types being on the market, it will be necessary to construct each item specially. The work of wrapping cable terminals can be greatly facilitated by the use of a very simple and efficient machine such as shown in Fig. 4. This device is designed along the lines of some which gave very good results in the aircraft factories and it can be constructed out of a regular breast drill and some miscellaneous materials by the station force. A very simple type of hard wire loop bender, which can be constructed similarly, is shown in Fig. 5. The proof-loading device being of lesser importance, no illustration is included but one may be constructed of two structural steel channels, with spacers between, some means for applying the load, such as a long lever, and a weight lifting mechanism for applying any desired load.

Equipment for Larger Stations

Every field or station at which much rigging of machines is to be done should be equipped with either a 12-ft. straightedge and two-way builder's level or a specially built level for checking of dihedral angles, etc. Fig. 6 shows a specially designed level of this type which has given very good service at some Naval stations. When rigging machines in the past it has been the custom to estimate the tension in wires by the expedient of "sounding" them. A more satisfactory method in every way would be the use of a device such as the Larsen Tensiometer, shown in Fig. 7, which has been quite thoroughly tested out by the Bureau of Standards.

Another item of special interest in airplane metal parts work is the Gray sheet metal cutter. This machine, which is made by the Savage Co., Knoxville, Tenn., is very valuable in profile cutting of sheet metal fittings. It makes use of a small automatic punch to shear the sheet, while roller feeds permit turning the piece freely as it is being fed into the machine. In this way any desired line may be followed. For radiator repair work, a testing bath, in which the entire radiator can be submerged, is very necessary if the quality of the repair is to be assured. A tank of this type can be built at the station, or by any local tinshop, out of galvanized sheet iron about No. 16 gage. It should be several inches wider than the radiator and about three inches deeper. In using the tank, the radiator openings are sealed with plugs, it is filled with air at about 6 to 10 lb. per sq.in. pressure and submerged in the testing tank. Any leaks immediately show up as the air bubbles out. An ordinary automobile tire pump is entirely suitable for furnishing the air pressure. For repairing of wheels, some type of wheel assembly and aligning stand should be provided. Several types of these are now marketed for garages and are equally suitable for airplane work. Fig. 8 shows one device which is very suitable for this purpose.

Engine Repair Requirements

Airplane engine repairs may be generally divided into two classes, minor and major overhaul. The first usually covers cleaning of the engine, grinding of valves, general examination and readjustment, while the second includes anything from a thorough overhaul to complete rebuilding according to the condition in which the engine is found when it is taken apart. Table IV outlines the practice of the Air Mail Service in the maintenance of its Liberty-12 engines. This outline is fairly applicable to these and other engines in civil use and should be of value in giving a clear impression of the manner in which the work is handled. It is well to note, however, that recent aircraft engines (and particularly American models) are giving evidence of considerably increased life. As an example of this, an Aeromarine Model U8D recently passed a 300-hour endurance test while a Wright Model E2 passed a 250-hour test for the U. S. Navy. At the end of these tests, during which only slight adjustments were made, each of the engines was developing its full horsepower, indicating that its useful life was by no means at an end. With overhauls and replacements, such as would have been made in regular service, its useful life might safely be expected to extend a few hundred hours longer.

The first essential in the way of engine repair equipment is some means for lifting the engines into and out of the airplanes and moving them around the shop. Without doubt, the most economical method is to use one of the smaller sizes of chain blocks for this work. The weight of modern airplane engines ranges from 400 to 1,800 lb. and this is constantly increasing as larger models are developed. It is, therefore, not advisable to provide chain blocks of less than 2,000 lb. capacity and still larger sizes, such as 3,000 lb. capacity, are preferable. Of the three types on the market, differential, worm and spur geared, the latter is the most efficient while the first is the lowest in cost. The following table

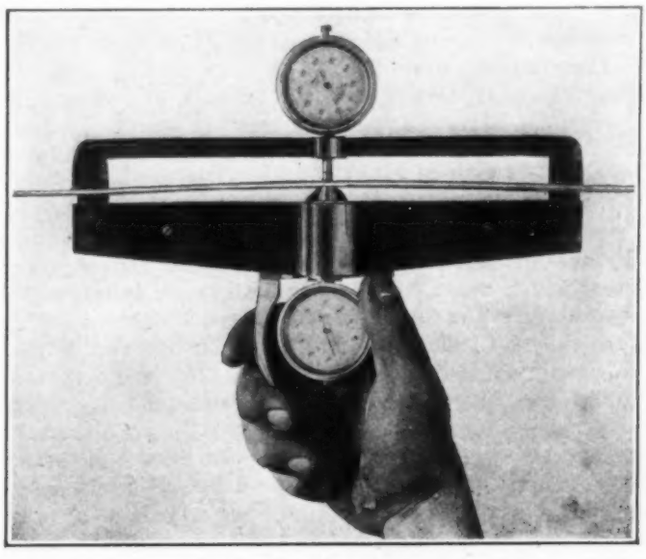


FIG. 7—TENSIOMETER

of the net cost of Yale Chain Blocks, as of August, 1922, is given to show the comparison:

Capacity in Lb.	Differential	Worm	Spur Geared
1,000	$15.00	$33.33	$46.70
2,000	20.16	40.00	60.00
3,000	25.92	53.33	80.00

If at all possible with the funds available, an overhead track for these chain blocks should be installed. Two types of track are in general use, the I-beam and the light pressed-steel type. Where the unsupported spans are short and there are many curves or switches, the pressed steel type will be cheaper to install. On the other hand, where there are long spans without intermediate supports and few switches, the usual condition in station shops, the I-beam type will be cheaper. Fig. 9 shows a track of the latter type installed at Kelly Aviation Field, San Antonio, Texas.

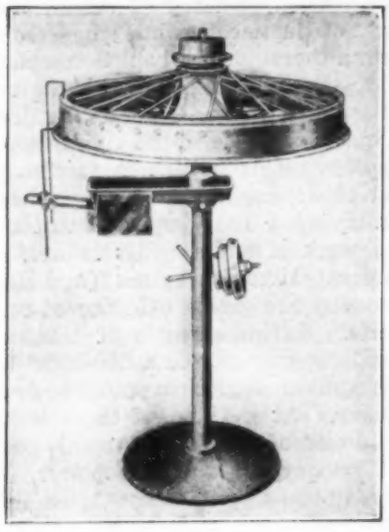


FIG. 8—WHEEL REPAIR STAND

Rough estimates of preliminary cost of either type of track, completely installed, can be safely based upon $1.00 per ft. for capacities up to 2,000 lb., while tracks of about 5,000 lb. capacity can be installed for about $1.50 per ft. Curves and switches are not included in these prices. The curves will cost about $4.00 per ft., installed, for the small sizes. Very short installations of track will run slightly higher in cost per ft. and it would be advisable to increase the above figures by about 25 per cent in such cases. Where the tracks are installed, they should be arranged so that the chain blocks may be used for lifting engines out of the airplanes, carrying them to the overhaul stands and to the test stands. The latter will usually require carrying the tracks outside of the buildings on special supports, which may be of timber or structural steel, and which are not included in the cost figures given.

For complete overhauls of engines, one or more engine assembly stands and test stands are practically essential. Several types of assembly stands are now on the market and one of these, the Herschell-Spillman, shown in Fig. 10, has been extensively used in both airplane engine factories and stations. A stand of this type can be purchased for less than the cost of building a makeshift device. The test stand is an item of equipment which must be specially built, none being on the market. This stand is used to support engines during test runs at full speed with propeller or fan brakes. For ordinary work it is not necessary for the test stand to be provided with a torque balance and it can be fastened rigidly. The stand should be provided with adjustable engine supports which can be set to accommodate any engine likely to be overhauled or tested. It should also be provided with either a radiator or other water cooling system, gasoline and oil feeding and measuring systems, thermometers, tachometer, wire screen propeller guard and such pressure gauges as may be required for checking operation of the particular engine to be tested. An installation which may be regarded as typical is shown in Fig. 11. The cost of these stands will vary so much with the equipment, such as discarded tanks, etc., available for their construction that no reliable estimate can be given.

A number of special wrenches will be required for each type of engine likely to be received for overhaul and adjustment and a few of the smaller items of machinists' tools will also be necessary. Several galvanized iron pans for washing of engine parts in kerosene should be included and, if very extensive work is contemplated, it will be found economical to install a pressure system for washing these parts with a kerosene spray. A small bench arbor press, or lightweight floor press of the garage type, is a very useful addition to the equipment and will save much time in disassembling and reassembling some of the engine and other parts. The garage type of press has the advantage over the small bench press that it can also be used for other work than engine repairs, such as removing or replacing wheel bushings, etc. The bench press does not provide sufficient clearance for this latter class of work. A very suitable type of press is illustrated in Fig. 12. Where the press equipment is provided, a set of gear pulling clamps should also be included.

A set-up for checking the ignition equipment of each type of engine to be overhauled should be built. Such apparatus must be developed at the station and for each type of engine as nothing in this class is now on the market. The important feature in this ignition checking equipment is the provision of some means for checking the operation of the distributors and readjusting them on a "dummy" set-up before they are reassembled with the engines. Line reamers for the main bearings of engines and some suitable jig for checking the alignment of pistons and their connecting rods will be found necessary. The jig should include some means for straightening bent rods or the tools for this work

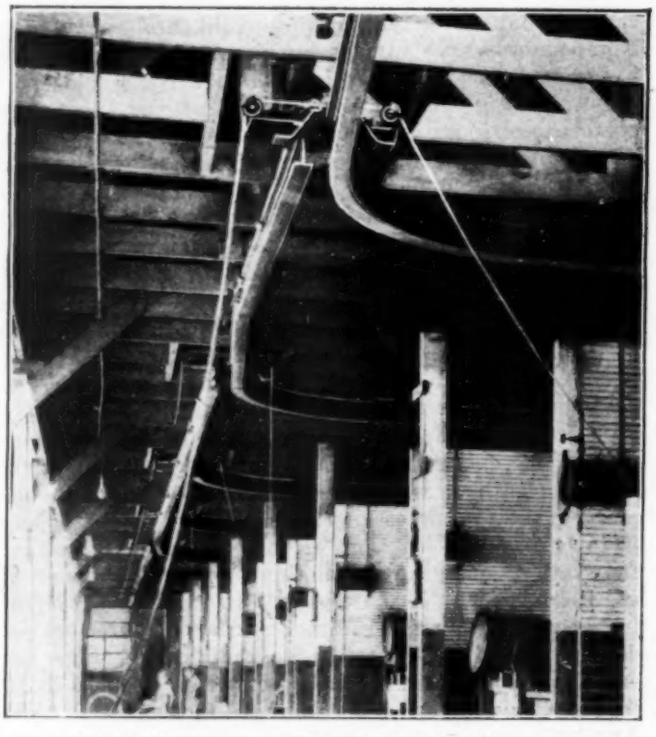


FIG. 9—OVERHEAD TRACK INSTALLATION AT KELLY FIELD

should be separately provided. As airplane engine pistons and connecting rods must be very carefully balanced in sets before assembly into the engine, an accurate scale should be provided for this purpose. The Toledo Scale Company, Toledo, O., make a special piston and rod balancing scale for this work which has been used quite extensively. However, any scale of precision class may be used although not quite so conveniently as the special Toledo balancing model.

Typical Shop Arrangement

Present air station shops vary so greatly that it becomes quite a problem to pick one which can be referred to as typical of the majority. Probably the nearest to a typical shop would be the Cleveland shop of the U. S. Air Mail Service which, through the courtesy of J. V. Whitbeck, Eastern Supt., is shown in

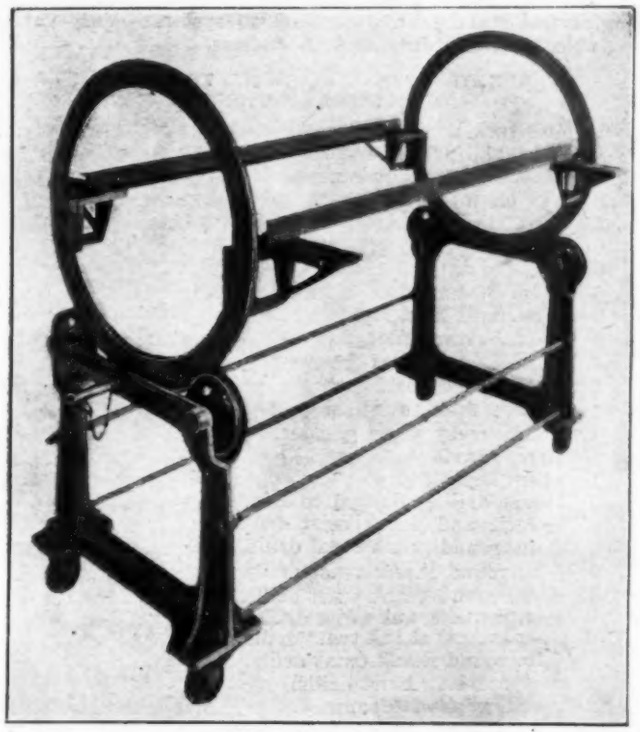


FIG. 10—ENGINE ASSEMBLY STAND

Figs. 13 and 14. This shop is classed by the Air Mail Service as a "maintenance" one, only minor engine overhauls and airplane work of a secondary nature being done there. The complete engine overhaul work and rebuilding of airplanes are both confined largely to the Chicago shops. Fuselage sides are built, and similar work of the reconstruction class is done in the Chicago shops and the assembled units are shipped to Cleveland and similar shops for assembly into complete airplanes. The Chicago plant thus falls more into the class of reconstruction base rather than a repair shop and, while it is naturally more completely equipped than the Cleveland one, it is, for this very reason, less typical of the civil station shop than the latter. As the use of landing fields and seaplane bases develops, the shops may be expected to gradually develop and their equipment to be increased until it approaches that of the factory. For the present, however, the Cleveland case probably forms the best comparison with the civil station where the major work is carried back to the engine and airplane factories.

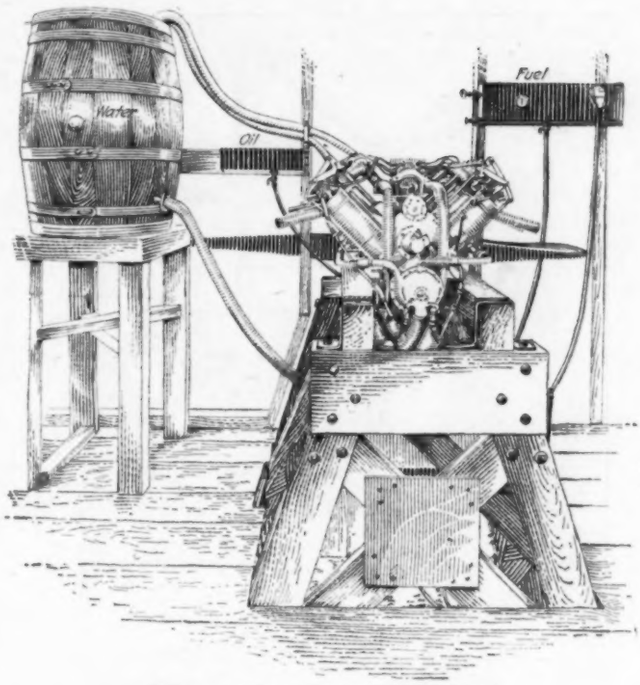


FIG. 11—ENGINE TESTING STAND

TABLE I—COMPLETE LIST OF AIRPLANE REPAIR EQUIPMENT WITH SOME APPROXIMATE COSTS

Carpenter's small tools—Variable. Largely furnished by mechanics themselves.
Carpenter's benches—Variable, built at station.
Circular saw—14-in. saw with tilting table, $325 (Drive, 3 to 5 hp.).
Band saw—36-in. saw $225 (drive, 2½ to 3 hp.).
Jig saw, ceiling fastened—$155 (drive, 1½ to 2 hp.).
Double spindle shaper—$475 (drive, 3 to 5 hp.).
Jointer—12-in., $325 (drive, 3 hp.)
Planer (wood)—24-in., $535 (drive, 5 hp.).
Fuselage jigs or benches—Variable, built at station.
Wing jigs or benches—Variable, built at station.
Electric hand drill—1 speed, chuck to ¼ in., $40.50; 2-speed, chuck to ½ in., $77.40.
Glue pots—Nominal.
Steam box—Built at station.
Sewing machine—2-needle type, with folder and motor, $225.
Exhaust fan for dope room—Variable. Capacity: complete change of air every two to three minutes.
Vacuum cleaner, portable—$315 complete (used for cleaning fuselages).
Propeller balancing stand—$75.
Universal balancing mandrel—$12 to $15.
Propeller checking table—$75 to $100.
Radiator testing equipment—Bath and air pump, possibly $10.
Sheet-metal workers' small tools—Variable.
Soldering-iron heater—Gas type from $5 up.
Small sheet metal beader—Bench type, hand operated, $55.
Gray sheet metal cutter—For ¼-in. stock, $450 (drive, 1-hp.). For ⅜-in. stock, $700 (drive, 2-hp.).
Cable terminal wrapper—$50 to $60.
Hard wire loop bender—About $15.
Wire and cable proof loader—Variable.
Pipe bender—Hand operated, geared, capacity to 2-in. pipe, $260.
Acetylene welding set—Small portable sets from $55 up.
Blacksmith's forge—With blower and water tank, $55.
Blacksmith's anvil, 200 lb.—$30.
Power hacksaw—Cutting to 3-in. x 3-in., $32 (drive, ¼ hp.)
Vertical drill—Sensitive, chuck to ½-in. $135 (drive, ½ hp.).
Vertical drill—Screw feed, chuck to 1-in., $145 (drive, 1-hp.).
Power grinder—Two 1-in. x 8-in. wheels, floor stand, $35 (drive, ½ hp.).

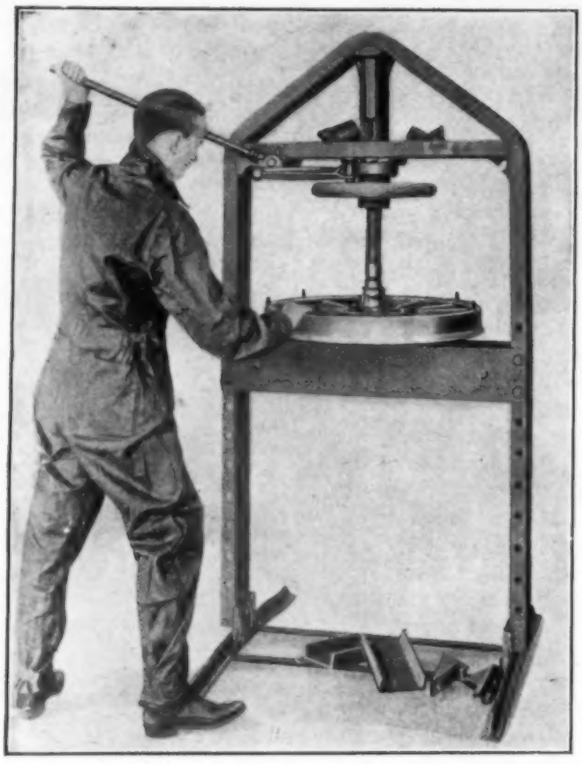


FIG. 12—FORCE PRESS SUITABLE FOR REPAIR WORK

Wheel repair stand—$30.
Dihedral checking level—About $15 to $20.
2-way builder's level—$5.
Tensiometer—No quotations.
Spare parts and materials storage—Variable.
Wing panel trailer—Varies greatly with discarded parts available.

TABLE II—COMPLETE LIST OF ENGINE REPAIR EQUIPMENT WITH SOME APPROXIMATE COSTS

Engine overhaul stand—$54.
Chain block—2,000-lb. capacity, $20 to $60 (see text).
Track for chain block—$1 per foot, up (see text).
Special tools for engines—Varies for each type.
Machinist's small tools—Variable, many furnished by the mechanics.
Small arbor press—Bench type $58, floor, garage type, $80.
Kerosene washing pans—Nominal.
Ignition testing setup—Variable.
Piston and rod alignment jig and straightening tools—About $60.
Valve trueing tool—Nominal.
Main bearing line reamer—Martell type, about $700.
Compressed air system for cleaning parts with bench hose, (100-200-lb. pressure)—Very variable.
Kerosene pressure system for washing parts—Very variable.
Gear pulling clamp—$5 up.
Machinist's benches—Built at station.
Piston and rod scales—$90 up.
Piston vise—$10.
Screw-cutting lathe—10-in. x 48-in. lightweight, without chuck, $125 to $230 (drive, 1-hp.).
Screw-cutting lathe—12-in. x 60-in. heavyweight, without chuck, $475 (drive, 2-hp.).
Engine spares and materials storage—Variable.
Stationary oil can with faucet or pump, 5-25 gal.—Small can with faucet from about $10 up.
Engine test stand with water and oil systems—Very variable, built at station and oil systems.

TABLE III—ESSENTIAL SMALL TOOLS FOR OPERATING STATIONS

2 6-oz. tack hammers.
4 12-oz. ball pein hammers.
4 20-oz. ball pein hammers.
2 2-lb. engineers hammers.
2 10-lb. sledge hammers.
6 14-in. mill files, flat.
6 14-in. bastard files, flat.
6 14-in. bastard files, ½ round.
6 10-in. mill files, flat.
6 10-in. bastard files, flat.
6 10-in. bastard files, ½ round.
6 10-in. round files.
1 24-in. x 16-in. steel square.
1 bench emery wheel grinder.
1 100-lb. anvil.
1 14-in. keyhole saw.
2 breast drills, chuck 0 to ⅜-in.
6 1/16-in. round shank twist drills.
6 3/32-in. round shank twist drills.
6 ⅛-in. round shank twist drills.
6 5/32-in. round shank twist drills.
6 ¼-in. round shank twist drills.
6 5/16-in. round shank twist drills.
6 ⅜-in. round shank twist drills.
2 reciprocating hand drills.
2 countersinks for same.

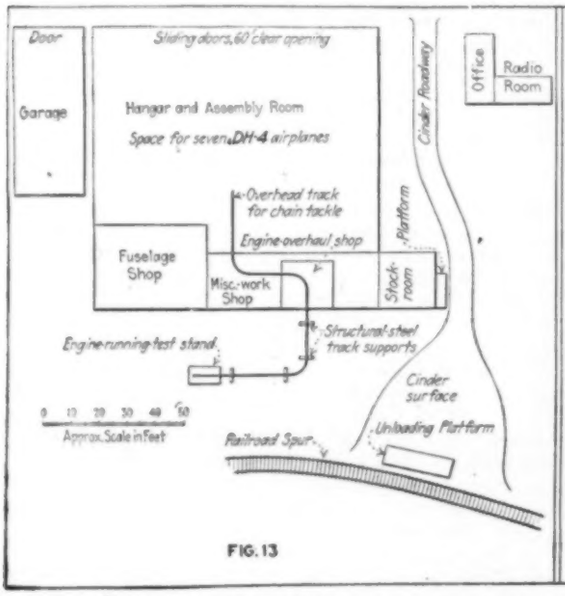


FIG. 13

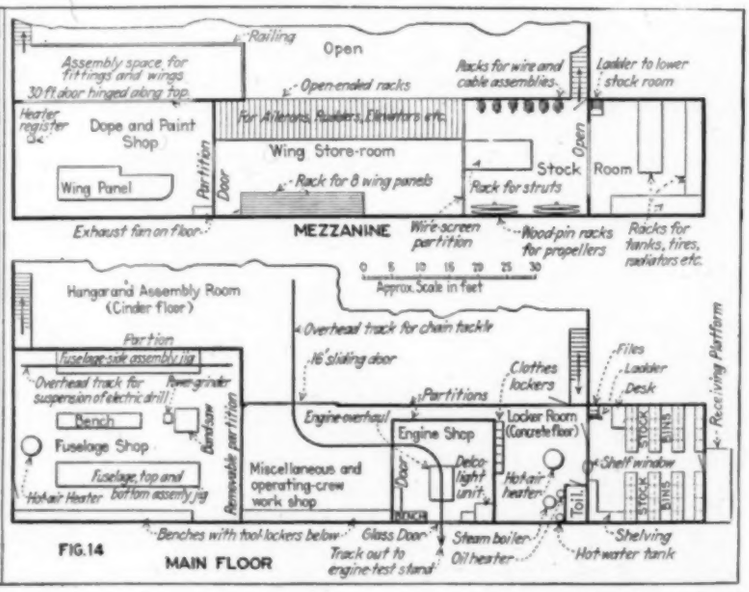


FIG. 14

FIG. 13—GENERAL ARRANGEMENT OF AIR MAIL REPAIR SHOPS AT CLEVELAND. FIG. 14—DETAIL ARRANGEMENT OF AIR MAIL REPAIR SHOPS AT CLEVELAND

6 48-in. bench clamps.
2 10-in. C-clamps.
2 8-in. C-clamps.
2 6-in. C-clamps.
2 blow torches.
4 soldering coppers, large and small.
1 ratchet brace, 10-in. sweep.
1 ½-in. to 1½-in. expansion wood drill.
1 1½-in. to 3-in. expansion wood drill.
1 10-in. dividers.
1 adjustable mitre box.
1 stiff-back mitre saw.
1 26-in. rip saw.
1 26-in. crosscut saw.
1 24-in. fine tooth veneer saw.
3 hack saw frames.
24 10-in. 18-tooth hack saw blades.
1 10-in. draw knife.
1 6-in. coping saw.
2 ratchet screwdrivers.
2 Yankee countersinks.

TABLE IV—PRACTICE OF THE AIR MAIL SERVICE IN MAINTENANCE OF LIBERTY-12 ENGINES

NEW ENGINE

Set up on test stand and operated at various speeds while adjustments are being made and operation checked. Total period of run about 1 to 2 hours with few minute run at full power. Engine given external examination, cleaned and put into service.

AFTER FIRST 100 HOURS OF SERVICE

Entire engine taken apart, cleaned and examined for worn parts. Valves ground and a few parts such as rings, valves and wrist pins sometimes replaced. Reassembled, carburetors and electrical system adjusted. Operated for 3 to 5 hours on test stand.

(Among other civil operators the tendency is to keep below these figures and test runs range from ½ hour upwards.)

AFTER SECOND 100 HOURS OF SERVICE

Engine taken apart, etc., as before. Replacement of parts such as rings, wrist pins, valves, valve guides, gears, water pump shafts, generally required. Cylinders sometimes require replacing. Some main bearings replaced and all main bearings line reamed and lapped with arbor. Engine reassembled, adjusted and tested as before.

AFTER THIRD 100 HOURS OF SERVICE

Engine taken apart, etc., as before. Parts previously mentioned require quite general replacement. Often necessary to also replace: valve springs, connecting rod bearings, valve rocker arms, thrust bearings, and crankshafts. Engine reassembled, adjusted and tested as before.

AFTER FOURTH 100 HOURS OF SERVICE

Engine usually (but not always) withdrawn permanently from service, according to conditions found when it is dismantled. When withdrawn, as many parts as possible are salvaged, the following being the more important ones generally usable: crank case; 2 or 3 cylinders; connecting rods; cam shaft assembly; cam-shaft drive; some gears; some thrust bearings; water pump; manifolds; carburetor and a large part of the electrical system.

Overhauls average 160 man-hours each.

Effect of Variations in Design of Milling Cutters on Power Requirements and Capacity

BY BENJAMIN P. GRAVES AND JAMES A. HALL

THIS PAPER comprises the results of a study of the effect of changes in the number of teeth, spiral angle, rake angle, and cutting speed of a milling cutter on power consumption, tendency to chatter, and stresses set up in the machine. The first consideration in the choice of methods was that all tests as far as possible should be made under actual shop conditions, using, however, sufficient refinement of measurement to give a high degree of accuracy in the results.

The first step toward getting definite information concerning power requirements was to drive the spindle and table by separate motors. A prony brake was then placed on the arbor and a series of tests run to get the efficiency of the spindle drive at different capacities and speeds. The proper treatment of the power required by the table is a more difficult problem. The authors took as the net power required by the table the difference between the motor output under load and that when driving the feed mechanism alone.

High-speed-steel cutters 3½ in. in diameter were used on practically all of the tests, the only exception being a few tests with two 6-in. side milling cutters. All of the 3½-in. cutters used in the tests to determine the effect of the number of teeth had 30-deg. spiral angles and 10-deg. rake angles. As the formula derived by Professor Airey and Mr. Oxford called for 20 teeth in such a cutter, this cutter was put at one end of the series, a Brown & Sharpe standard cutter with eight teeth came in the middle, and a four-tooth cutter was added to give an extreme condition of coarse spacing. A number of tests were also made with a 10-tooth cutter. Additional comparisons were made between two 6-in. side milling-cutters, one of which had 12 teeth and the other 26 teeth. Other sets of cutters alike in every particular except the element to be studied were used in the tests to determine the effect of variations in spiral angle and rake angle.

PROCEDURE OF THE TESTS

As the only object of the investigation was to compare cutters, mild steel was used in all the tests. From two to six tests were made at each depth of cut in the 18 in. of length of the block. The exact figure for the feed was determined by taking the time with a stop watch and measuring the distance traveled. In this way the exact amount of metal removed per minute was determined. A number of tests were also made on a special fixture to measure horizontal and vertical pressures by the use of two Kenerson traction dynamometers. The results of the tests are plotted in the form of curves having as one co-ordinate either horsepower per cubic inch per minute or pressure along the table.

Several groups of tests were run in the studies of the effect of varying the number of teeth in the cutter. In the first group the speed and depth of cut were kept constant and the feed varied. This of course varied the chip per tooth and the output in cubic inches per minute and gave the comparison between cutters where equal

Abstracted from a paper presented at a joint meeting of the Philadelphia Local Section and the Machine Shop Division of the American Society of Mechanical Engineers, the Engineers' Club of Philadelphia, and the Philadelphia Section of the American Institute of Electrical Engineers, at Philadelphia, Feb. 27, 1923.

finish is required for corresponding capacities and cuts.

The second group contains tests where the feed and depth of cut were kept constant and the cutting speed varied. This gave a constant output and a variable chip per tooth. For the same feed per tooth the best surface finish is secured with the coarsest-tooth cutter. In the third group the depth of cut was kept constant and the cutting speed varied with the feed so as to give a constant chip per tooth. The output of course varied with the speed. This made a good study of the effect of the cutting speed on power requirements.

An equation was developed from the data obtained which gives a limit beyond which there is no saving in power when the cutting speed is lowered to give coarser chips per tooth.

Conclusions from the Data

It would doubtless seem from the data obtained that the efficiency of milling is increased by greater feeds per tooth. If these heavier chips are secured by using lower cutting speeds, the loss in the table becomes greater, the cutter itself requires more power per unit of metal than would be required for the same chip at higher speed, and the pressures between cutter and work become greater. The answer from the standpoint of power efficiency alone is, then, to use the cutter with the fewest possible teeth and to run it at higher speeds where the size of the chip is too great. The limitations to this practice are the danger of hammer or shock due to lack of continuity of cutting, and the possibility of overheating the edges of the teeth due to the heavy pressures and high speeds. The structural strength of the tooth itself is not a limitation in well-designed cutters, as this is practically always greater than the strength of the key or the arbor. The relation between the overheating of the edges of the teeth and the number of teeth in the cutter can only be settled by judgment.

A large number of runs were made on a set of three 10-tooth cutters having spiral angles of 10, 20 and 30 deg., respectively, and on two 20-tooth cutters having spiral angles, respectively, of 20 and 30 deg. In addition two series of tests with a 3-tooth 60-deg. spiral cutter were made. The average of the tests shows practically no difference in power required for the different spiral angles. In the case of the 3-tooth cutter the authors believe that the lower power requirement is due to the number of teeth instead of the spiral angle.

While increased spiral angles showed no advantage from the standpoint of power, they were of very great benefit in reducing tendency to chatter and in giving smoother action. The vertical pressure between cutter and work was also somewhat less. The end thrust with the 60-deg. spiral cutter was not noticeable as far as the machine was concerned. In general a considerable spiral angle is desirable, the only limitations being end thrust and the danger of burning the sharp corners at the ends of the teeth if the work extends beyond the end of the cutter.

Effect of Rake Angle

Tests were made with three 10-tooth cutters having rake angles of 0, 10, and 20 deg. and with two 20-tooth cutters having 0 and 10 deg. rake. The increase in rake angle from 0 to 10 deg. caused a saving in power of 20 to 25 per cent, and a somewhat smaller saving was shown on the increase to 20 deg. On the other hand, tendency to chatter increased only slightly between 0 and 10 deg. rake, but became so great as to definitely limit the capacity of the cutter when increased to 20 deg. This limitation seemed to be much more serious than the danger of burning or chipping the edge. Rake angles of 10 deg., therefore, are desirable on cutters, but any considerable increase beyond this point limits the usefulness of the cutter.

Causes of Chatter

Chatter rather than the power of the machine is often the limiting factor in milling. For this reason many engineers urge that more rigid machines be built to eliminate this trouble, without realizing that a great deal may be accomplished by the proper choice of cutters. A summary of the elements which affected chatter in these tests is therefore given in the following paragraph.

The most important point in connection with this subject is the fact that tendency to chatter was greatly reduced as the number of teeth in the cutter approached a low figure. On many cuts where it was impossible to eliminate chattering of the 20-tooth cutter by any reasonable change in speed, absolutely no trouble was experienced with the 4- or 8-tooth cutters. Furthermore some trouble was experienced with the 8-tooth cutter on wide and deep cuts at high feeds, but no chattering occurred on any cuts with the 4-tooth. Increase in spiral angle also reduces the tendency to chatter, and a combination of wide-spaced teeth and steep spiral angle in a cutter will give the maximum capacity along this line. Moderate rake angles increase the tendency to chatter but little, while large rake angles greatly decrease the capacity of the cutter. The proper consideration of these factors in the choice of cutters will eliminate much trouble in this respect.

General Conclusions

Coarse-tooth milling cutters require less power to remove a given amount of metal per minute than fine-tooth cutters. This is true on both wide and narrow work, although the margin in favor of the coarse-tooth cutter is greater on wide cuts. It is also true if both cutters are compared on a chip-per-tooth basis.

When compared on a chip-per-tooth basis the finish given by the coarse-tooth cutter is better than that by the fine-tooth cutter on account of the closer spacing of revolution marks.

Low-cutting-speed operation of fine-tooth cutters to give a large feed per tooth is objectionable on account of the increased stresses in the machine and holding fixtures.

Fine-tooth cutters are much inferior to coarse-tooth cutters when the relative tendency to chatter is considered.

Moderate rake angles reduce the power consumption and are desirable on all cutters to be used on mild steel. Large rake angles are undesirable, due to the tendency to chatter.

The spiral angle has little effect on the power consumption. A considerable spiral angle is desirable, however, because it makes possible the use of fewer teeth, gives smoother cutter action, and reduces the tendency to chatter.

Hence, with the few exceptions noted, coarse-tooth cutters of the type now generally manufactured are superior to fine-tooth cutters for all classes of production work.

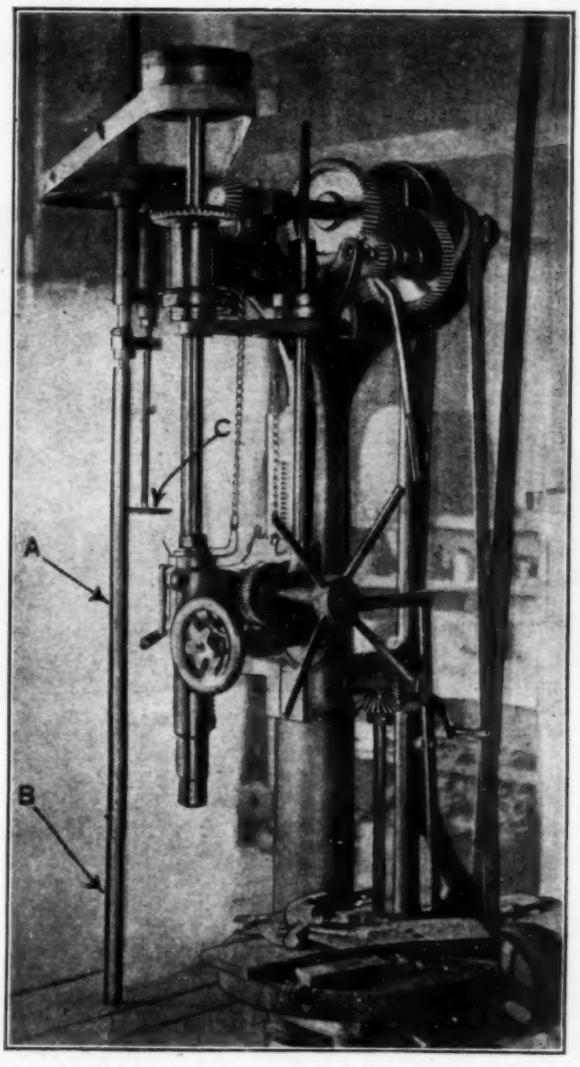
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

Large Work in a Small Machine

BY GEORGE ALLEN

The article "A Large Repair Job in a Small Lathe," by George Wilson, on page 971, vol. 57, of the *American Machinist*, reminded me of a scheme I saw used in a small repair shop a few months ago. This shop was located in a district where a large number of pulleys and gears five or six feet in diameter often came to the shop to be rebored and bushed or fitted to larger shafts. The shopman possessed only a 16 in. lathe and a drilling machine and the way he rigged up to bore out the large



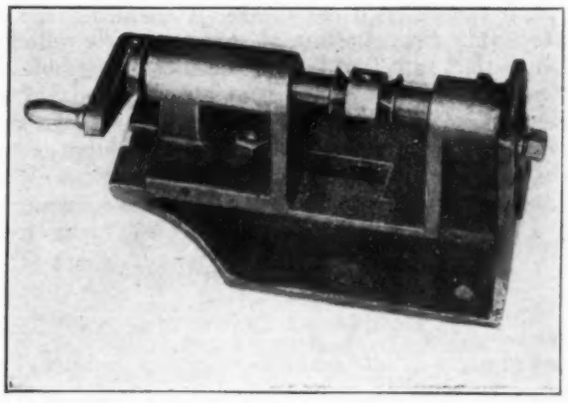
DEVICE FOR BORING LARGE GEARS AND PULLEYS

gears and pulleys is shown in the illustration. The boring bar *A* is held in a bracket bolted to a heavy overhead support and driven by means of a belt from a pulley on the upper end of the machine spindle to a pulley on the boring bar, as shown. The lower end of the boring bar is guided by a bushing in the floor. The cutting tool is set into the bar at *B* and the feed is obtained by turning the handwheel *C*. The bar can be disconnected at the upper end and removed while the work is being placed in approximate position on the floor. The bar is then put in place, the work clamped in position and the hole bored out as desired. It can easily be seen that the size of work that can be bored on this device is only limited by the distance the boring bar bracket is set from the drilling machine. A good feature is that the heavy work does not have to be lifted up onto the machine or supported in any special way, as is so often the case.

Fixture for Drilling and Tapping Collars

BY E. A. THANTON

I ran across a rather unusual drilling and tapping fixture a short time ago. The fixture shown in the illustration, was made to be used on a small drilling and tapping machine for holding small collars of various sizes while drilling and tapping the setscrew hole. My



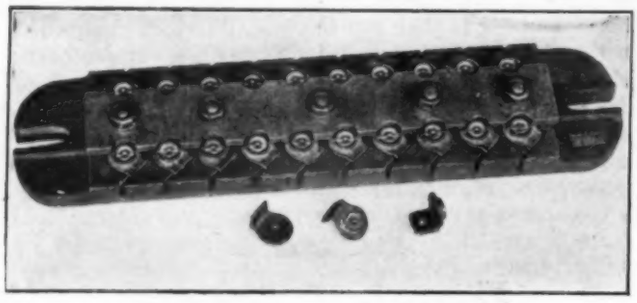
A COLLAR DRILLING AND TAPPING FIXTURE

first thought was "Why don't they use a V-block and strap clamp?" but found that the tapped hole had to be square with the center line of the larger hole and that the outside of the collar was not always concentric with the inside. For this reason it was thought best to locate from the bored hole rather than from the outside of the collar. While a fixture of this kind is more trouble to make, it both locates and clamps the work at the same time. Bored and reamed bushings of considerable length can also be held in this fixture by adjusting the bracket holding the clamping spindle. Both spindles are adjustable, though the rear one is locked in place with a setscrew after the proper position of the work has been found.

A Very Simple Milling Fixture

By E. V. Allen

The real ability of a tool designer is quickly shown by the complication or simplicity of the tools he designs. No better example of simplicity can be produced than the fixture shown in the illustration. It has few parts, is easy to make and fully answers the purpose. Three of the parts to be milled are shown in the foreground, and all that is required is to mill a shallow slit across the round boss, at an angle to the base. The bed plate of the fixture is slotted at the proper angle to receive the bases of the brackets. These slots were cut in with an end mill so that the end of each slot could



A VERY SIMPLE MILLING FIXTURE

be used as a stop for the piece to be put into it. The clamping plate is fitted over five studs and springs press the plate upwards when the nuts are loosened. The clamping plate is of mild steel and the base of cast iron, a key being set into the bottom of the base to locate it in relation to the slot in the milling machine table. Two slitting saws are used and 20 pieces are finished at one pass.

A shop visitor once asked why wing nuts were not used to clamp down the top plate, but a little reflection will show that sufficient pressure could not be obtained with wing nuts unless a wrench was used, so why not a T-handled socket wrench in the first place? In some cases a lever nut might be used to advantage but on this fixture, eccentrics or lever nuts would only be in the way and cause more trouble than the nuts shown.

Running-in Bearings

By Herbert Crawford

The running-in of crankshaft and connecting rod bearings is becoming more and more a regular practice in automobile motor building and these illustrations show the method being used by the Chalmers Motor Car Co. of Detroit, Mich. Fig. 1 shows where the connecting rods are being run-in, the somewhat unusual feature being the substitution of a plain shaft of the proper diameter for the crankshaft itself. A set of rods to be run-in is shown at *A* while at *B*, down in the tank, are rods clamped in place on the running-in shaft. They are covered with lubricant and the shaft revolved by a motor at the right. It requires only a comparatively short time to run-in these bearings to a good surface which has proved so satisfactory that a new motor can be driven at almost any desired speed without nursing as is usually the case.

The rods are prevented from turning by having the small ends rest on a bar which is hidden from view inside the tank. The cross handle socket wrench shown

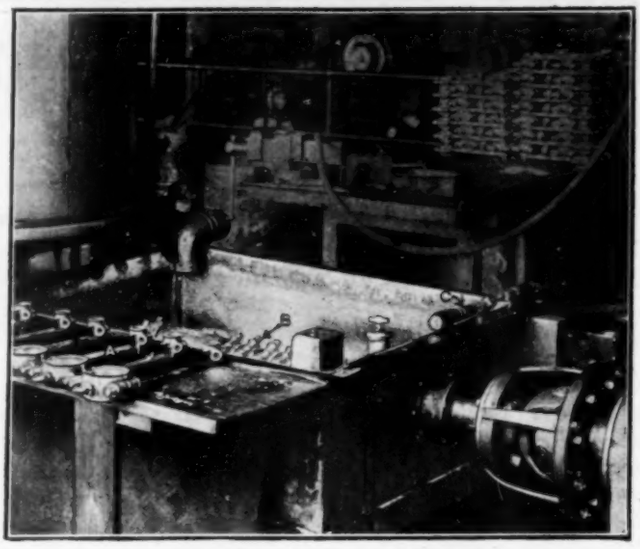


FIG. 1—RUNNING IN CONNECTING RODS

at *C* makes it easy to bolt the rod in place on the shaft.

The crankshaft itself is run-in in a manner similar to that shown in Fig. 2. The crankshaft has been mounted in the crank case but the connecting rods are not in position. The case is lowered into the tank it-

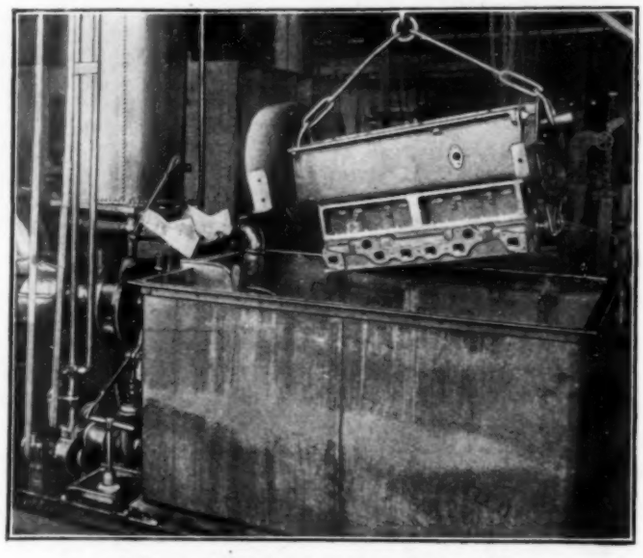


FIG. 2—RUNNING IN CRANKSHAFT

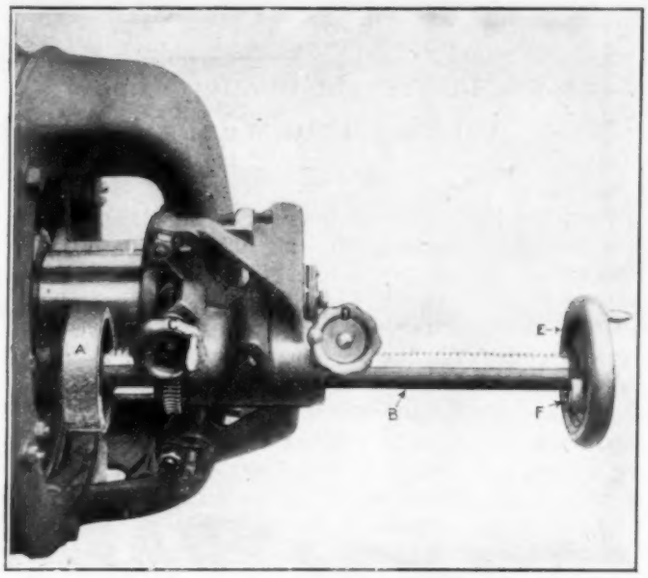
self and the crankshaft connected with a powerful motor at the left. The shaft is flooded with lubricant in the tank and the results secured are as good as those obtained when using the connecting rod bearings.

Commutator Truing Tool

By I. B. Rich

The simple commutator truing tool used by the General Electric Co. in its Schenectady plant and elsewhere, is shown herewith. The drum *A* on which a strip of sandpaper can be easily and quickly fastened by means of the clamp shown in front, is mounted on a shaft inside the quill *B* which is splined to prevent rotation as the commutator revolves against the drum. The quill *B* is mounted in an eccentric sleeve which is rotated by the worm and wheel shown at *C*, in order to bring

the drum in contact with the commutator. The drum is fed along the commutator by means of the rack shown on the bar, and a pinion, operated by the wheel *D*. The wheel *E* turns the sandpaper drum *A* into any desired position so as to bring a new surface in contact with the commutator, the pawl *F* preventing the rotation of the drum by the movement of the com-



COMMUTATOR TRUING DEVICE

mutator as it revolves. The pawl is double acting so that it can be used on commutators running in either direction. The device is easily clamped to the arms at the end of a motor or generator, as shown.

Tool for Cutting Felt Washers

BY H. L. WHEELER

Having occasion to make a lot of felt washers for the purpose of making some ink rollers, I designed the tool shown in the accompanying illustration to cut them. It was used in a drilling machine and revolves at a high speed.

A strip of felt was tacked to the surface of a maple board and the revolving tool pressed down upon it,

WASHER CUTTING TOOL

cutting out the washers quickly and cleanly. After getting started we found that we could tack two thicknesses of felt to the board and cut out two washers at a time as well as one.

The felt washers were ejected from the tool each time the latter was raised from the work by the circular stripper, which was held in the annular space between the inner and outer cutting edges of the tool by four studs passing through suitable holes in the upper part of the body and threaded into a similar ring of steel placed over the shank of the tool. Coil springs within the recess provided the pressure to eject the felt washers, and the nuts above the upper ring served to adjust the stripper just flush with the cutting edges.

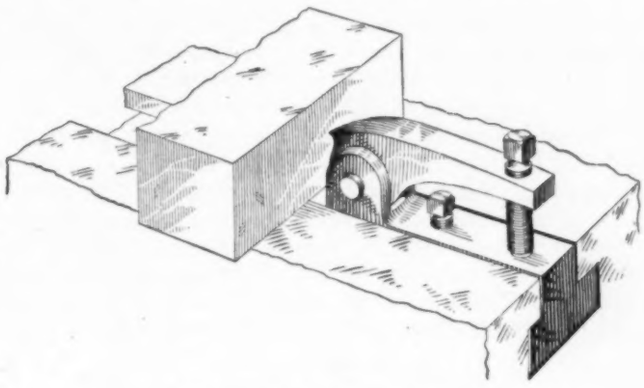
The circular center that would be cut out with each washer was ejected by a plunger in the inner bore of the tool, actuated by the same springs through the medium of pins extending through elongated slots in the shank of the tool and engaging with the upper ring.

Clamp for Use on Planer

BY G. A. LUERS

The clamp shown in the attached sketch is a handy tool for use on the planer when it is desired to hold comparatively thin work that must be clamped in such manner that the planer tool may pass over the clamp.

The body of the clamp is made to fit the T-slot in the planer bed, and the screw through it serves to fasten



CLAMP FOR USE ON PLANER

the clamp against endwise movement. The short end of the lever should be made sharp and hardened.

A thin piece of work may easily be held by a pair of these clamps so placed as to oppose each other. Tightening the screw in the long end of the lever forces the sharp edge into the metal and at the same time draws it down on the planer bed.

Broken Piston Rings for Parallel Strips

BY G. W. NUSBAUM

In any machine shop where automotive engines are repaired, broken piston rings are plentiful and are usually consigned promptly to the scrap box. The writer wonders if many of the workmen in such shops realize that these pieces make excellent parallels for small jobs upon shaper, milling machine or drilling machine, where thin pieces of this nature are needed.

Piston rings are ground to very close limits of accuracy and therefore may be depended upon for size. They are made in a variety of widths, so that by a judicious sorting of the broken pieces as many pairs of the different widths as may be desired can be obtained. The curvature of the ring is of additional advantage as it gives the equivalent of a wide bearing upon the work and assures right angle alignment.

Making a Drill Cut Oversize

By William J. Thirkettle

A few days ago I had occasion to make a number of small rollers of high speed steel, the bores of which were required to be 0.254 in. in diameter. As the job was a rush one and every moment of delay could be reckoned in dollars of loss to the company, I sought some quicker method of making them the right size other than by boring them in a lathe.

As a standard E drill is 0.250 in. and F, the next size larger, is 0.257 in. in diameter, I was at a loss as to how to produce the correct bore quickly. Just then

ENLARGING A DRILL FOR A TEMPORARY JOB

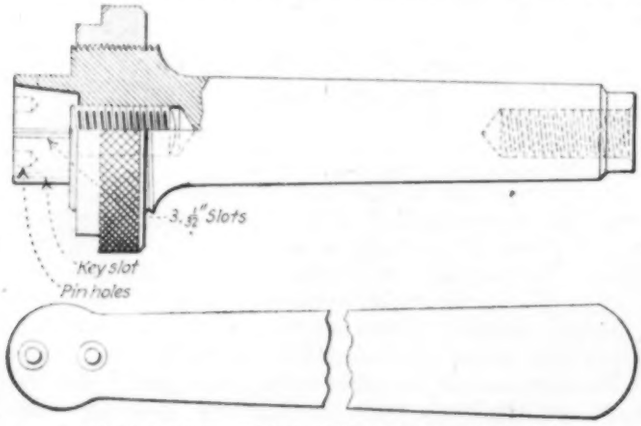
the superintendent came along and when I had told him my difficulty he took the E drill to the bench, laid the end on the corner of the vise jaw and struck each lip in turn a succession of light blows with a hammer. In the sketch herewith, the letter *X* shows where the drill was struck.

The result was all that could be desired. The rolls, 20 in number, were first drilled with a ¼-in. standard drill and followed by the enlarged E drill, used as a reamer. The latter cut to the right size and the job was soon finished. A few moments work with an oil stone restored the enlarged drill to its normal size.

Expanding Arbor to Hold Small Cutters

By E. Lytton Brooks
London, England

The cutter arbor shown in the accompanying sketch was designed and made up to meet an emergency, and although it does not appear to be a very sound mechanical proposition, it worked very well on the job for which it was made and has been used since on many other jobs.



EXPANDING ARBOR FOR SMALL CUTTERS

It is designed to hold milling cutters about ½ in. thick and having a 1 in. hole, and is used in the vertical head of the milling machine.

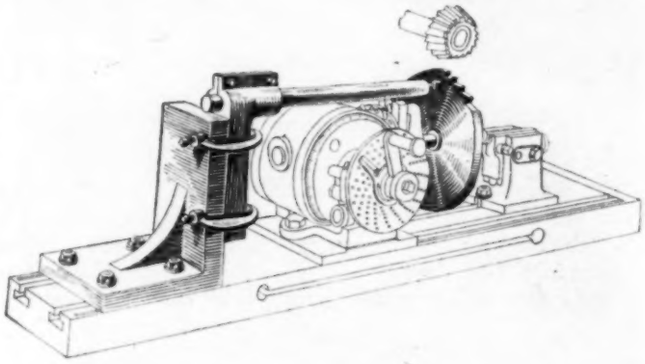
The part on which the cutter is held is bored taper and slit in three places to allow it to expand. A conical-head screw fits the taper bore and the threaded end enters a ½ in., 20 pitch, tapped hole beyond the taper bore. The pin wrench shown beside the arbor is used to draw up the screw and expand the shoulder within the bore of the cutter. The knurled ring is threaded to the outside of the arbor to release it from the spindle and has two flats milled upon it so that an ordinary spanner may be used if required.

Kink to Prevent Chatter when Milling Thin Work

By R. McHenry

When cutting some ratchets of rather large diameter and thin section in the milling machine, I experienced the usual trouble from springing and chattering of the work under the cut. After several abortive attempts to apply a back stop I evolved the rigging set forth in the accompanying sketch.

An angle plate was bolted to the table of the machine back of and facing the index head, and to the face of



IMPROVISED BACK STOP FOR MILLING MACHINE

the plate was clamped a large adjustable splining tool that belonged to the planer equipment. The adjustable feature of the tool allowed me to set the bar to any length desirable, and the tool-holding setscrew in the end of the bar provided a convenient means of setting the stop against the work and releasing it each time the work was to be indexed.

Cutting Spiral Flutes With a Planer

By Donald A. Hampsen

Spiral fluting is always an interesting job, and when the work is performed without standard equipment it becomes even more so. Work that must be accurate cannot well be turned out with makeshift tools, but there are many cases of spiral fluting where a twist only is required; no mating parts and no extreme accuracy entering into consideration. Such a job is illustrated herewith.

Several feed rolls were to be fluted. A spiral flute was required in order to keep the rolls from grooving the work and to prevent a thin sheet metal chip scraper, which was used in connection with the rolls, from catching in the cuts as they revolved. It was decided that a twist of 2 in. in the length of 27 in. would be satisfactory. No milling machine large enough for the

job was available, and so the work had to be done on a planer.

The illustration, Fig. 1, shows how the fluting was done. Plain centers supported the rolls. A tool bit ground to the desired shape of flute was fed into the work to a given depth, as determined by reading the

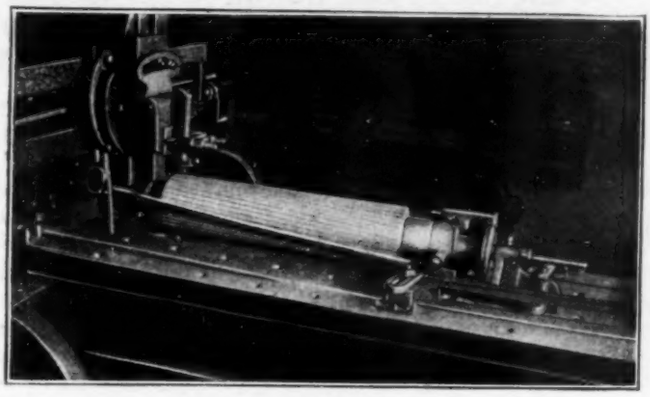


FIG. 1—CUTTING SPIRAL FLUTES WITH THE PLANER

micrometer dial on the vertical feed screw. A change gear having the desired number of teeth was taken from one of the lathes and screwed to the end of the roll journal; two holes having been drilled and tapped in each roll for this purpose. An angle plate having a ¾-in. hole through one leg at the height of the center line was bolted near the front end and the index pin was passed through this hole to engage the teeth of the gear. Direct indexing followed each cut, but the pin was withdrawn each time after the division had been made and the work again clamped. Fig. 2 shows this set-up.

But two special parts were required. One of these was the casting shown in Fig. 1 clamped to the front journal, and in detail in Fig. 3. The hub of this casting was split and provided with a clamping bolt, so that the roll journal could be turned within it for indexing, and then clamped rigidly to guide the roll during the cut. The coil spring, Fig. 3, serves to keep the guiding roller on the end of this lever always against the inclined bar that serves to impart the partial rotative movement to the work.

The inclined bar is a piece of 1-in. square steel taken from the stock rack. It was suspended at one end from

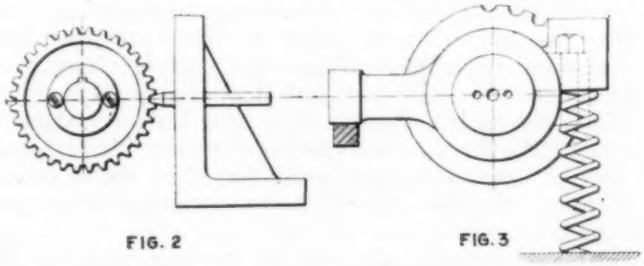


FIG. 2—THE INDEX. FIG 3—GUIDE LEVER AND ROLL

the saddle of the planer, while the free end rode upon another piece of steel that was clamped to the table and traveled with it. By this means scoring of the planer table was avoided, and the inclined bar was brought up to coincide as nearly as practical with the center line of the roll.

With this equipment flutes were cut at the rate of twenty per hour, and with highly satisfactory results.

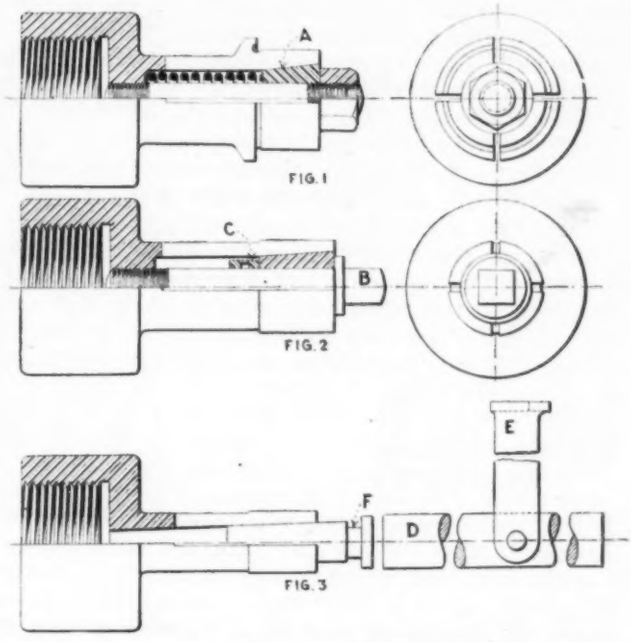
Design of Expanding Arbors

BY NELSON HALL

Expanding arbors carried on the spindle nose of screw machine or lathe are valuable tools for second operation work if so designed as to grip the work securely, yet to collapse readily and allow the work to be removed and replaced without trouble.

To make such an arbor open powerfully requires the angle of taper to be small, while to close readily the opposite condition must obtain; therefore the designer is obliged to juggle between these extremes in order to get a satisfactory tool. If he fails in either direction, the tool is liable to undergo some severe usage, especially if the operator is on piece work. After some experimenting, the writer has adopted the forms shown in Figs. 1, 2 and 3, and by their use has greatly reduced complaints of sticking and failure to hold.

In Fig. 1 the arbor is expanded by drawing the cone *A* into the shell by means of the nut, while the coil spring behind it has sufficient strength to overcome the tendency of the cone to stick when the nut is loosened.



FIGS. 1, 2 AND 3—DESIGNS OF EXPANDING ARBORS

With the taper slightly less than is regularly used on spring collets, this form works well.

As the angle becomes smaller for the purpose of increasing the gripping power, or the size of the arbor is reduced to accommodate small work, the style shown in Fig. 2 gives excellent results. In this case the cone is pushed in by the head of the screw *B* and is withdrawn by the collar *C* that is pinned to the body of the screw.

Sometimes the work is so small as to preclude the use of a threaded plug, and in Fig. 3 is shown such a tool with a plain taper plug to expand it. If the taper is made Brown & Sharpe or Morse, it will stay in position by reason of its frictional grip. To operate it the tool *D* is placed in the turret or tailspindle so that a push on the end serves to drive in the plug and grip the work, while to withdraw it the latch *E* is swung down so that the yoke engages with the groove *F* in the plug.

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KENNETH H. CONDIT AND FRED H. COLVIN
Editors
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Putting on More Than the Traffic Will Bear

ANOTHER INSTANCE of the operation of economic laws to correct business inequalities is mentioned in a recent issue of *Commerce and Finance*. It has to do with the practical monopoly of the supply of raw silk by the Japanese.

The assurance of a steady supply of raw material at a price free from unreasonable fluctuations is essential to the satisfactory operation of any manufacturing business. In the case in point silk men flatly say that the wide fluctuations in prices are due to the gambling of the Japanese speculators and dealers. What has been the result? Desiring to free themselves from the uncertainties attendant upon the price of Japanese silk, American silk men have turned to the development of substitutes and at this year's exposition more than half the products on exhibition are made entirely of cellulose fiber or contain appreciable amounts of it.

Faced by a somewhat similar situation American rubber men are turning their attention to the development of an assured raw material supply under American control which also goes to show that when the channel of trade is obstructed, the current breaks through and cuts a new path, eventually leaving the old one dry and barren.

Give the Customer What He Wants

LIKE most general rules, slogans and catch phrases, this one has enough substance and truth about it to make it dangerous. The rule is about one hundred per cent right in a cigar store, ninety per cent in a grocery store and no good at all between patient and doctor. How good is it when the salesman handles machinery or tools?

To put the thing in the proper light, to what extent is the salesman a mere seller and to what extent a doctor? Answering the question ourselves, we would say that he should be a doctor primarily, but that unlike the doctor, he has the right to sell the patient poison, if that is wanted—provided that he has properly explained and warned.

There are a few things required to make it possible for the salesman to act as doctor. In the first place there should be that confidence in him which we generally give to our doctor. We may say to our family, "I don't think the stuff will do me any good," but as a rule we take it anyway and we live up to Doc's instructions—at least for a time. On the other hand, though claiming that doctors do not know much, we recognize the fact that we ourselves know less and we follow their advice. The controlling fact is that we believe in their superior knowledge. Can we say the same of machinery and tool salesmen?

We have gone far away from the machine tool salesman whose main qualification was the amount of booze he could stow before he got muddled about the price list, but have we arrived at the point where the customer will recognize him as an expert adviser, not only as to the machine he sells but also as to the work which can be done with it?

Of course such a man is not merely a salesman, he is an engineer. Sales engineer some call him. If he is a real engineer, knows his subject, and knows how to present it, he has all the requisite qualifications. The customer will take care of the selling.

We are getting more and more of such men but, as yet, there are not nearly enough of them. When all sales of machinery and tools are so handled we'll cease to advise the machinery dealer to "give the customer what he wants," and we'll advise the customer to "take what the engineer recommends."

Report of the Joint Committee On Reorganization of Government Departments

WHEN the Harding administration first took office there was much talk of reorganizing the executive departments upon a more efficient basis. Those wise in the ways of Washington shook their heads at the enthusiasm of the advocates of reorganization for they knew the overpowering inertia of the long-intrenched bureaucrat.

Events have proved the accuracy of their judgment. The report of the joint committee of three senators and three representatives covering the changes suggested by President Harding and his cabinet has just been presented to the Senate by Mr. Smoot. It falls short of the ideal in some particulars but includes most of the important changes urged by students of the government.

The merging of the War and Navy Departments in a Department of Defense is logical but is sure to raise a storm of opposition that may prove the undoing of the whole project. The concentration of all engineering functions in one department is entirely sound and should arouse little opposition. Other important changes are the transfer of all non-military functions from the War and Navy Departments, the establishment of the new Department of Education and Welfare and the removal of all non-fiscal functions from the Treasury Department. The Post Office Department becomes the Department of Communications and independent bodies except those of a general service or quasi-judicial nature are attached to departments.

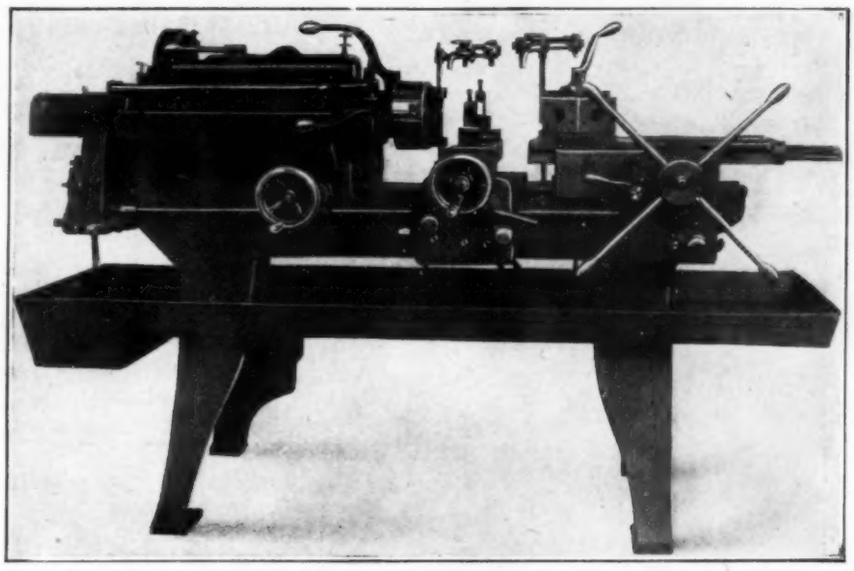
The general plan is a distinct forward step for our processes of government and merits the support of progressive citizens everywhere. No action can be taken before the present Congress expires but the plan should be a live issue before the next one. In the meantime it will pay to study and discuss the recommendations of the committee and prepare to get behind them.

Shop Equipment News

Foster All-Geared-Head Screw Machines Nos. 3, 5 and 7

The latest addition to the line of screw machines made by the Foster Machine Co., Elkhart, Ind., is the all-geared-head machine. These machines are of three sizes, Nos. 3, 5 and 7, having capacities, respectively, of 1⅛, 1⅜ and 2½ in. for round bars.

The specifications of the geared-head machines are identical with those of the friction-head machines of the same sizes, as described on page 953, Vol. 51 of *American Machinist*, except for the head. Instead of the three-step cone pulley with back-gears, the head mechanism now consists only of gears, which are driven from a single pulley that can be belted to a motor or countershaft.



FOSTER ALL-GEARED-HEAD SCREW MACHINE NO. 3

The No. 3 machine, shown in the accompanying illustration, has eight spindle speed changes ranging from 29 to 500 r.p.m. A 2-hp. motor running at 1,800 r.p.m. is employed to give a speed of 920 r.p.m. to the drive pulley. The total cross and longitudinal travels of the slides are, respectively, 8¼ and 10 in. The swing over the bed is 14½ in. Six power cross feeds are available for the cross slide ranging from 0.0027 to 0.025 inches.

On the Nos. 5 and 7 machines eight spindle speeds are also provided, ranging from 24 to 414 r.p.m. and from 20 to 337 r.p.m., respectively. On the former size a 2½-hp. motor running at 1,800 r.p.m. rotates the driving pulley at 760 r.p.m., and on the latter a 3-hp. motor at 1,800 r.p.m. rotates the pulley at 780 r.p.m. The swings over the bed are, respectively, 17½ and 20 in. for these types.

The total cross and longitudinal travels and power cross feeds of both the larger types are identical with those of the friction head machines of similar size. The cross travels are 10 and 11 in., the longitudinal travels 10 and 12 in., respectively, and the power cross feeds 0.0031 to 0.028 in. for both types. The machines can be furnished with either power or hand screw feed to the cross slide.

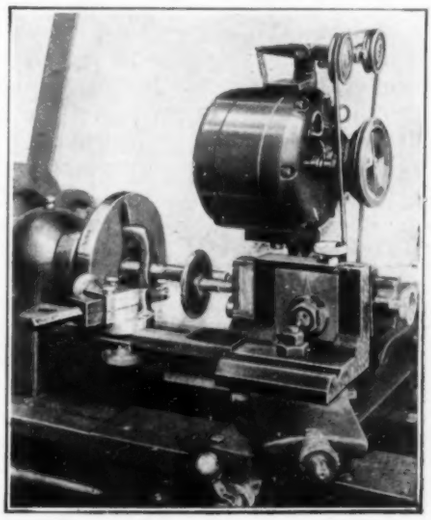
The machines are regularly furnished with an automatic chuck having a master collet, bar feed, hand cut-off slide with hand longitudinal feed, power feed to the turret slide, two-speed friction countershaft, oil pump and wrenches.

"Precision" Improved Grinding Attachment

An improved "1923 model" multi-graduated precision grinding attachment has recently been placed on the market by the Precision & Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa. Like the former model, described on page 160, Vol. 52, of the *American Machinist*, the machine illustrated herewith can be used on a variety of work, though particularly intended for thread grinding.

The grinding spindle has been redesigned entirely. The spindle, which is heavier in this model, and the driving pulleys are machined from one piece of special heat-treated alloy steel. The arrangement eliminates lost motion or slippage due to loose pulleys. The rear bearing is so constructed that should there be an elongation of the spindle due to an increased temperature, the bearing may float.

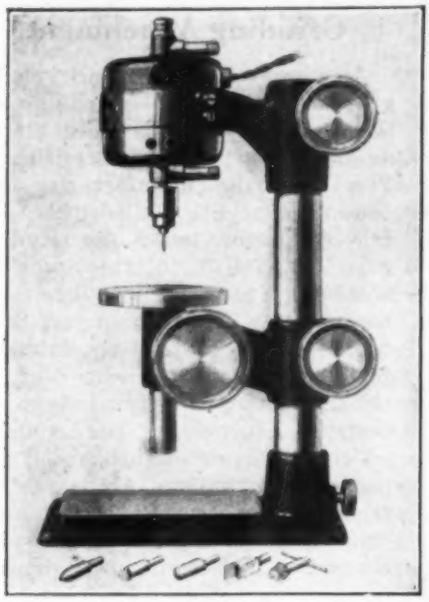
A ¼-hp., fully enclosed, ball-bearing, statically and dynamically balanced motor is used. It is so built as to minimize vibration and chatter. Other features of the machine are ball bearings in the idler pulleys, an improved index for setting the helix angle; and a dust-cap on the grinding spindle to exclude dust. Improved oiling devices have been provided.



"PRECISION" IMPROVED MULTI-GRADUATED GRINDING ATTACHMENT

Dumore Electric Sensitive Bench Drilling Machine

The motor-driven sensitive drilling machine shown in the illustration herewith is a recent product of the Wisconsin Electric Co., Racine, Wis. The machine is adaptable to small



"DUMORE" ELECTRIC SENSITIVE BENCH DRILLING MACHINE

work where accuracy and sensitiveness are required.

The work table of the drilling machine is sensitive because it is operated by a rack and pinion feed which is governed by the operator's hand. There is a depth gage regulated by a thumbscrew to control the depth of the hole. The table is 3½ in. in diameter. The center of it is 3 in. from the vertical column of seamless steel tubing, thus permitting work 6 in. in diameter to be drilled at the center. The center of the table is bored and reamed to fit the shanks of drilling fixtures that are a part of the regular equipment. The fixtures shown in the illustration consist of a cone center, cup center, radius center and a V-block. The radius center is milled to facilitate the drilling of rings and similar pieces of work.

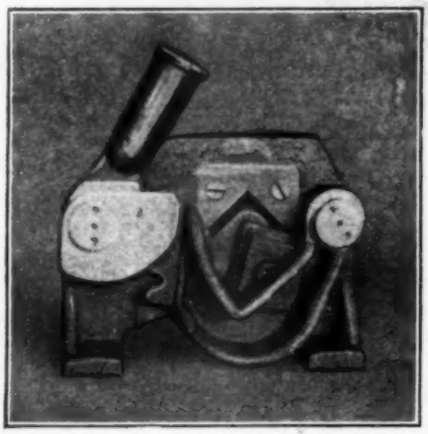
A No. 9 Jacobs chuck is used, with a capacity up to ½ in. To make the drill concentric, the gripping points of the chuck jaws are ground.

The machine is equipped with a Dumore universal motor which is dynamically balanced and can be run with either a.c. or d.c. current. A ball thrust bearing takes up end play. Lubrication of the bearings is obtained by means of grease cups with wicks. Like the work table bracket, the motor can be raised and lowered on the column and then clamped by a quick-acting locking device. The motor itself can be detached and used as a portable hand drill.

The whole unit is mounted on a 5x8 in. base made of gray iron. Four screw holes permit the fastening of the base to a table or bench whenever necessary. The height over-all is 16 in. The motor brackets and base are finished in black enamel, the motor is nickel-plated and the control wheels are satin-finish aluminum. The machine is operated by means of a foot controlled rheostat that provides six speeds and an off position.

Whitney No. 4 Angle-Iron Shear

The machine shown in the accompanying illustration is the No. 4 hand-operated angle-iron shear which has recently been placed on the market by the Whitney Metal Tool Co., 91 Forbes St., Rockford, Ill. The



WHITNEY NO. 4 ANGLE-IRON SHEAR

machine is designed expressly for shearing angle iron in sizes up to 2x2x¼ in., will operate without the necessity of clamping the angle and will shear without distortion.

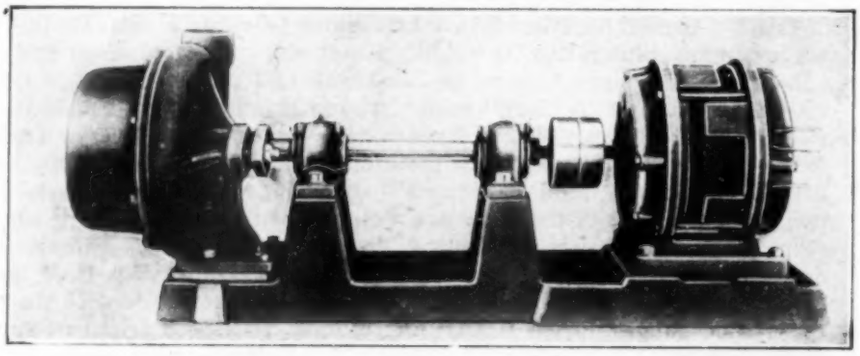
The frame is a solid steel casting and the cutting is done by means of inserted plates which are made of ½-in. tool steel, hardened and ground. A feature of the machine is a rest pad for the angle iron, which is cast integral with the frame of the machine. The two upper surfaces of the pad form an angle so that the iron can be sheared without distortion. Another feature is the eccentric gear by which uniform leverage is obtained with the handle at any position.

All parts which are subject to wear are of steel, hardened and ground. The machine is supplied with a short socket handle, so that a 1-in. iron bar or section of pipe can be used for a handle. The weight is 41 pounds.

"Fulflo" Ball Bearing Motor-Driven Centrifugal Pump

The Fulflo Specialties Co., Blanchester, Ohio, has added to its line of pumps a ball-bearing motor-driven self-priming centrifugal unit for pumping liquids such as coolant compounds, oils, brines and enamel. The pump, shown in the illustration herewith, is similar to the one described on page 465, Vol. 50, of the *American Machinist*, except that it is ball-bearing throughout and is of 75 gal. capacity.

The pump is of the centrifugal type and, having both intake and outlet located at the top, retains enough fluid for priming purposes without the aid of valves or other mechanical means. Being always primed, it begins pumping the instant the machine is started. The free-floating impellers and anti-clog features which expel chips without harm to the pump, are retained in this model. The pump will deliver from a few drops per minute to full capacity, depending on the regulation.



FULFLO BALL-BEARING MOTOR-DRIVEN CENTRIFUGAL PUMP

Dunning Air Compressors

The Dunning air compressor that is shown fitted in an automatic tank unit in the accompanying illustration has recently been marketed by the George Sachsenmaier Co., 926 North 3rd St., Philadelphia, Pa. The compressor is a compact unit with but few parts, so that its size is reduced to a minimum.

The cylinder, oil reservoir and base are in a one-piece casting, assuring rigidness, compactness and alignment of the assembled parts. The two cylinders extend horizontally through the length of the casting. The ends of the cylinders are covered with removable cylinder heads and hold the valves, which are large to prevent overheating. The valves are of steel bearing against cast-iron seats, and have a 30-deg. angle.

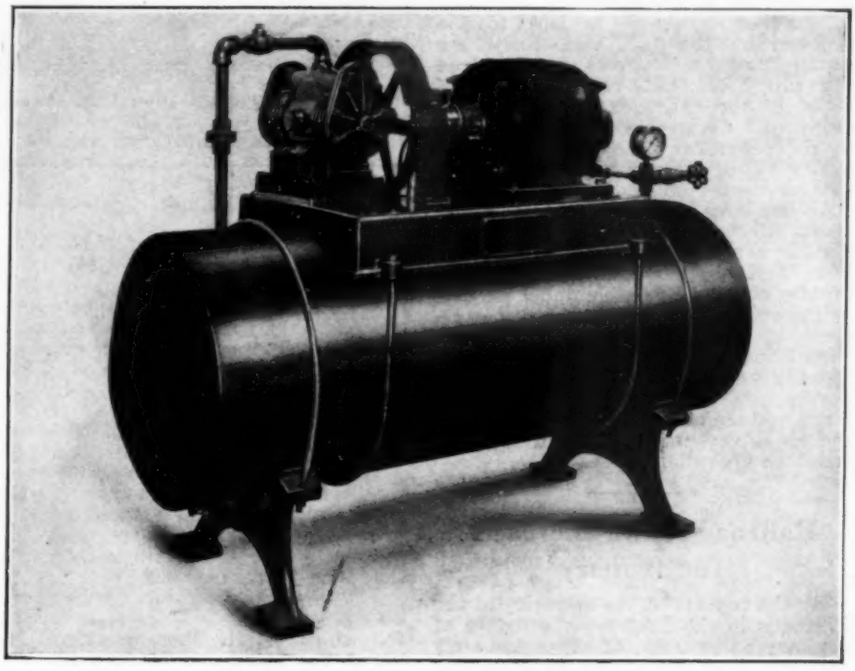
A long double piston of one casting is employed to reach from the end of one cylinder into the other cylinder. The piston is operated by means of a hollow eccentric shaft that fits into a bronze bearing large in diameter. Thus piston pins, crank bearings, connecting rods and short pistons are eliminated. The rotation of the shaft carrying the eccentric oscillates the piston back and forth and causes the compression of air at each stroke. Being double acting, the flow of air is regular and the load on the working parts is evenly distributed. Three piston rings at each end of the piston serve to prevent the loss of compression.

The bearing are all made of bronze. The main bearing in which the shaft rotates is fitted to the side of the cylinder casting and is held in place by four bolts. The other end of the shaft is supported by a small bearing within the cylinder.

Lubrication of the bearings is obtained by means of the forced feed system, operated by a little plunger pump that forces oil from the oil reservoir in the base. The oil is pumped to the main bearing, where it enters the hollow shaft and is fed to each working part by outlets which allow the proper amount of oil to pass through. The system is entirely automatic and needs only occasional replenishing of the oil.

The electric-driven compressor units are made in various sizes. Model A size is a ¼-hp. unit delivering 1¼ cu.ft. of air per minute and will develop 150 lb. per square inch pressure. Model B has a ½-h.p. motor, delivers 2½ cu.ft. of air per minute, and can build up 200 lb. pressure. Model C is a ¾-hp. unit delivering 3¾ cu.ft. of air, and is rated at 250 lb. pressure.

The automatically controlled tank units are made in two sizes. One is the Model B unit having a working pressure of 150 pounds per square inch, and the other the Model C unit with a working pressure of 175 lb. The tanks are respectively 14x36 in. and 16x48 in., each tested to withstand 400 lb. pressure.



DUNNING AIR COMPRESSOR IN AUTOMATIC TANK UNIT

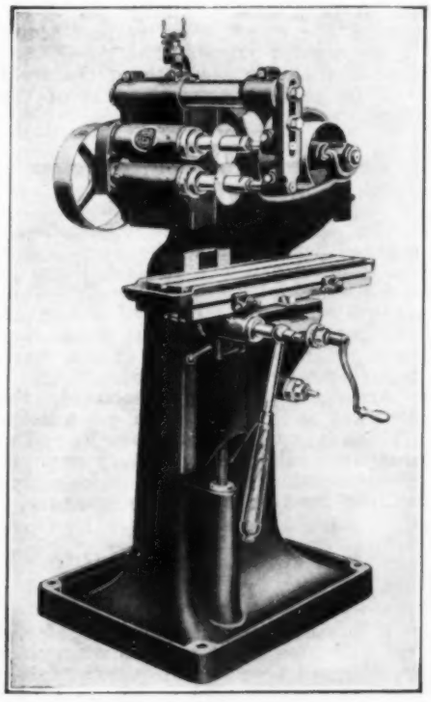
U. S. Double-Spindle Hand Milling Machine

The accompanying illustration shows a double-spindle hand milling machine that has recently been placed on the market by the United States Machine Tool Co., Cincinnati, Ohio. The machine is intended primarily for milling the step slots in piston rings and for similar work such as opposite keyways in small shafts.

The feed movements of the machine are operated by hand only. The upper spindle is adjustable from the lower a distance of 1¼ in. to allow for wear of the cutters. The spindles are drop forged and run in bronze bearings. The two arbors are provided, one running right and one left, to enable the machine to pull two cutters at the same time in opposite directions. The machine requires 2 hp. to run it and can be belted directly to a motor or to a countershaft.

The working surface of the table is 7x23 in. with a longitudinal movement of 6 in. by means of a hand lever and of 16 in. by a crank. A 5 in. hand cross feed and 15¾ in. vertical feed are provided. Close adjustments of the table position are made by means of micrometer dials.

The machine weighs 950 lbs. It can be furnished with either a two- or three-step cone pulley and a friction pulley countershaft to match.



U. S. DOUBLE-SPINDLE HAND MILLING MACHINE

News Section

Wagner Speaks on Welding Practice Development

"Electric Welding Applications, Old and New" was the subject treated by R. E. Wagner, of the General Electric Co., Pittsfield, Mass., when speaking before the Metropolitan Section of the American Welding Society at New York City on Feb. 27th. Mr. Wagner spoke from his broad experience in welding and gave particular attention to the welding of thin metals. The use of both slides and motion pictures to illustrate the points, made his lecture doubly interesting.

The gradual change in the practice of arc welding was brought out, as the carbon electrode was supplemented by the use of a filler rod, and then as the metallic electrode came into use. For metal as thin as $\frac{1}{8}$ in., Mr. Wagner said that welding could not well be employed, although electric resistance welding is well suited for this work. Furthermore, resistance welding is becoming increasingly popular for welding $\frac{1}{8}$ in. and thicker material, where quantity production is required. Its chief drawback is that a rather expensive machine is required for each piece of work. Pictures of the machines in operation were shown on the screen and actual samples of different welds were displayed.

In addition, Mr. Wagner told of a method employed for making by means of arc welding, cheap but satisfactory bending dies for use on a bull-dozer. He concluded his talk by telling of the construction and testing of a large steel box or tank that was made for determining the strength of various types of arc welded joints. The results indicated that the strength of the weld was, in general, equal to that of the plate.

Ford Company Will Develop Mississippi Dam

The Federal Power Commission granted permission to the Ford Motor Co. to develop power at High Dam, on the Mississippi River between St. Paul and Minneapolis. Both of the cities had desired to develop this power, but they willingly consented to the work being done by the Ford Co.

According to the agreement, the company is to file with the commission its plans within four months. The company will be required to pay the Government a reasonable price which will be fixed in a future agreement.

Railroads Prove Value Says Bank Survey

"The increasing importance of the railroad problem is emphasized by the pronounced shortage of transportation facilities, which may arrest in the not distant future the present upswing of business activity in this country," according to the current number of *The Guaranty Survey* issued by the Guaranty Trust Co., New York. "The vital dependence of our entire economic organization upon railway transportation is daily becoming more obvious, and there cannot be continuing prosperity for the country as a whole without efficient service by the railroads.

"Further emphasis is lent to the problem by the fact that there are pending before Congress one hundred and thirty-four bills relating to regulation of the railroads. Many of the proposed measures, which are designed to reduce railway net income by reducing rates, railway valuation, or the rate of return on railway value, have doubtless been inspired by the improvements effected in the railroad situation, despite serious handicaps, during the last several months, through the greater efficiency possible under private management and the gradual betterment of general business conditions. This is especially true as regards the steadily improved earnings of the railroads, due chiefly to the continued large volume of traffic which has kept the gross revenue large, and to economies in operation.'"

Railroads Show Increases for January

By the reports of the majority of the railroads in the East for the month of January, increases of approximately fifty per cent are shown as compared with the business done during the month of January, 1922. The Baltimore & Ohio shows a gross income of 30 per cent and the rise in operating expenses were kept down to about half this amount.

The Southern Pacific, Illinois Central, Philadelphia & Reading and several other roads show marked gains for the initial month of the year. There was but one exception in the increase reports, that of the Lehigh Valley which showed a deficit of $837,007 after taxes were paid as compared with an earning of $359,802 reported during the same month last year.

Canadian Pacific to Improve At Many Points

Extensive improvements are planned by the Canadian Pacific Railway to be started in the near future. Rock ballasting on the main lines and on two of the subdivisions is contemplated. Additional trackage will be provided at many of the stations to take care of longer freight trains that are now being operated. Steel water tanks of from 60,000 to 100,000 gallons capacity will be erected at five points on the railroad. Modern coaling plants will be installed at two divisional points and station facilities will be extended at several places. It is expected that the expenditure will run into several millions of dollars.

Standards Committee Plans New Finance Method

A new plan for financing the industrial standardization work of the United States, which provides for membership dues on the basis of one cent per $1,000 of gross receipts, has been formally approved by the Executive Committee of the American Engineering Standards Committee. Twenty of the most influential industrial executives of the country have accepted places on an Advisory Committee which will co-operate with the Ways and Means Committee in the refinancing of the American Engineering Standards Committee.

In submitting the report of the Ways and Means Committee, A. W. Whitney, chairman of that committee and of the A.E.S.C., declared that the economies which should accrue to the industries of America, through standardization, "are to be measured in billions of dollars, not millions."

This report announces a new class of members in the A.E.S.C. to be known as "sustaining-members," and provides a special service to "sustaining-members," including information bulletins on developments in standardization work in this country and in every other country where industrial standardization is in progress.

The newly created advisory committee of the A.E.S.C. consists of the following: W. H. Barr, president, National Founders' Association, Chicago; Charles E. Hodges, president, American Mutual Liability Insurance Co., Boston; A. W. Berresford, general manager, Cutler-Hammer Co., Milwaukee; L. F. Butler, president, Travelers Insurance Co., Hartford, Conn.; William Butterworth, president Deere & Co., Moline, Ill.; John J. Carty, vice-president, American Telephone & Telegraph Co., New York City; W. W. Coleman, president, Bucyrus Co., So. Milwaukee; G. B. Cortelyou, president, Consolidated Gas Co., New York City; J. K. Cullen, president, Niles-Bement-Pond Co., New York City; J. E. Edgerton, president, National Association of Manufacturers, New York City; John R. Freeman, Consulting Engineer, Providence, R. I.; Sidney J. Jennings, president, U. S. Smelting, Refining & Mining Co., New York City; J. W. Lieb, vice-president, New York Edison Co., New York City; John B. Morton, president, National Board of Fire Underwriters, Philadelphia, Pa.; Dr. Charles L. Reese, chemical director, E. I. DuPont Nemours & Co., Wilmington, Del.; E. W. Rice, jr., honorary chairman of the board, General Electric Co., Schenectady, N. Y.; Henry D. Sharpe, treasurer, Brown & Sharpe Manufacturing Co., Providence R. I.; S. W. Stratton president, Mass. Institute of Technology, Cambridge, Mass.; Ernest T Trigg, president, John Lucas & Co., Inc., Philadelphia, Pa.; and E. M. Herr, president, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Columbus K. Lassiter Dies Suddenly of Heart Disease

Columbus K. Lassiter, president of the Consolidated Machine Tool Corp., died suddenly late Saturday evening, March 3, as he was being carried into Roosevelt Hospital, New York, after having been fatally stricken while driving his automobile on Broadway, near 72nd Street. Mr. Lassiter was with his wife and daughter at the time and before leaving the Hotel Majestic, where the family resided, he complained of feeling ill. When the car reached Broadway, he became unconscious and was rushed to the hospital, where he

COLUMBUS K. LASSITER

died before he had reached the reception room.

Mr. Lassiter, who was one of the best known men in the machine tool industry, had an inspiring and busy career starting at the age of thirteen, when the death of his father forced him to leave school and enter into an apprenticeship in a blacksmith shop in Richmond, Va. He was particularly adept and took a great interest in the operation of all sorts of machinery and tools and in many ways displayed a creative instinct which stamped him as a born production manager.

In lieu of a school education, Mr. Lassiter studied diligently evenings and after his blacksmith apprenticeship he entered the office of a flour manufacturing concern which, at the age of nineteen, he was managing. At twenty he bought and operated a bakery and confectionery plant.

Despite his success, he felt the "urge" for machinery manufacturing and, selling out his enterprise, he entered the Richmond Locomotive Works as a timekeeper at $60 a month. Through his own ability, his steadiness of purpose and indefatigable work he rapidly rose at the locomotive works step by step until he was rewarded with the high honor of becoming vice-president in charge of production at the American Locomotive Co.

It was while in this capacity that the world war was commenced and again Mr. Lassiter proved his worth by the extraordinary work performed in the rebuilding of five of the plants and by the designing of many machines and tools which increased production and lowered costs.

In 1922, with Waldo H. Marshall, formerly president of the American Locomotive Co., Mr. Lassiter brought together the well-known machine tool manufacturing and selling organizations and completed the merger known as the Consolidated Machine Tool Corp. of America, of which he was president at the time of his death.

His ceaseless devotion to business and the constant strain placed upon his remarkably active mind are believed to have been contributing causes to his fatal illness.

Mr. Lassiter had the reputation of being one of the keenest buyers of machine tools in the market. If he was unable to find the tools that he needed, he was never for a moment dismayed, but went ahead and designed according to his own ideas.

Beside his wife, he is survived by two daughters, Mrs. Flavius B. Walker of Richmond, Va., Miss Lillian Lassiter of this city and his son, Robert R. Lassiter, secretary of the Consolidated Machine Tool Corp.

New Haven Heat-Treaters Visit Bellis Plant

A meeting in which there was quite a diversity of entertainment was held by the New Haven Chapter of the American Society for Steel Treating on the evening of Friday, Mar. 2. It took place in the shop of the Bellis Heat Treating Co., which is located in one of the buildings of the plant of the Geometric Tool Co., New Haven, Conn.

Before the meeting the shop was in full operation, to give the members the opportunity of observing the process of heat-treatment developed by Major A. E. Bellis. The work was performed on the standard chasers for Geometric die-heads, although the process is adaptable to a wide range of sizes and materials. Both gas and electric heated furnaces for the treatment of carbon steel were in operation. These furnaces contain a single crucible each in which there is a molten bath of the treating compound, designated as Lavite. The parts are merely brought to heat in the bath and then quenched in brine. Upon being dipped in boiling water the treated parts come out clean of all treating compound and scale.

The system employed for treating high-speed steel is particularly interesting on account of the speed and effectiveness with which the work is accomplished. The furnace that was operating was previously described on page 837, Vol. 54 of *American Machinist* and the process on page 888d, Vol. 54, in a report of a demonstration and meeting similar to the one just held. The furnace unit has three crucibles of the treating compounds, one for preheating, one for the high heat, which is usually around 2,200 deg. and the other for quenching. After quenching in the third bath, the work is further cooled in oil and then dipped in boiling water, which leaves it free from scale and compound. The ease of operation and the rapidity of the process are probably its most noteworthy features.

Adaptability of the System

The Lavite is furnished in various grades having melting and boiling points adapting it to various types of work. It does not attack the crucible nor the work, but allows uniform and rapid heating without scaling. The distortion of the work is stated to be very small by this method of treating. The system has been adapted to a variety of heat-treating processes.

The meeting following the demonstration was unique in that two of the national officers of the society were present, J. V. Emmons, treasurer and Wm. H. Eisenman, secretary. Mr. Emmons, who is metallurgist for the Cleveland Twist Drill Co., spoke on the effect of structure of steel upon the machinability. His talk was illustrated by slides showing microphotographs of specimens in various conditions.

The point was brought out by Mr. Emmons that machining properties do not depend upon hardness alone. In general, quite soft steel can be machined the most easily as regards turning, a harder steel most easily milled, while a still harder one is best for threading when using dies. The criterion in these cases is chiefly the finish obtainable.

Effect of Structure on Properties

The slides showed the structure of carbon steels that had been subjected to various treatments. The structure and amounts of ferrite, cementite or carbide of iron, pearlite and sorbite were pointed out in each view and the effect on machinability explained. When showing the softening effect of prolonged cooling, Mr. Emmons said that steel cooled slowly with other steel, so as to have considerable mass, was probably most suitable for general use where all types of machining must be done on each piece.

It is possible to anneal too slowly and thus to damage the steel, as particles of graphite become segregated throughout the specimen. This effect is not evident with high-speed steels, however, where the problem is to get them soft enough for machining. Mr. Emmons stated that on carbon steel the structural or microscope test is probably the most enlightening, although for high-speed steel more can be learned about the machinability from a hardness test.

Mr. Eisenman told the members of the growth and status of the American Society for Steel Treating. He also explained its policies and gave a general financial report. The meeting, which was well attended by an enthusiastic audience, ended with a luncheon to add to the sociability of the affair.

Invite Flyers to Gothenburg Aero Exposition

An official invitation has been sent by the Swedish Foreign office to the United States to participate in the International Aero Exhibition which will be held at Gothenburg, Sweden, from July 20 to Aug. 12, under the auspices of the Royal Swedish Aero Club. Major General Mason M. Patrick, chief of the Air Service, War Department, has already advised that Major Foulois, Air Assistant to the Military Attaché in Berlin, will be authorized to attend the Exhibit. Many events have been booked for the affair. Racing and other contests, all of an international nature, will be staged.

Machine Shop Section A.S.M.E. Holds Well Attended Meeting in Philadelphia

THE MACHINE Shop Section of the American Society of Mechanical Engineers which has been struggling to get started ever since its formation, seemed to find itself at the sectional meeting held in Philadelphia at the Engineers' Club on Monday, February 19th. The meeting was held in conjunction with the local sections of the A.S.M.E. and A.I.E.E. and included afternoon and evening sessions with an informal dinner for about 150 in between.

Mr. Charles Penrose, chairman of the Philadelphia Section, and Mr. Lewis H. Kenney of the Meetings Committee deserve great credit for staging the affair. Dr. R. H. Fernald, president of the Engineers' Club of Philadelphia, introduced Mr. Penrose as chairman of the afternoon meeting and Mr. E. B. Tuttle, chairman of the Philadelphia Section, A.I.E.E., to preside at the evening session.

At the dinner, short addresses were made by Mr. W. C. L. Eglin, chief engineer, Philadelphia Electric Co., and Mr. L. W. Wallace, secretary, Federated American Engineering Societies.

Two papers were presented at the afternoon session. They aroused discussion which lasted until after six o'clock. The first paper on Milling Cutters: The Influence of Differences in Design on Power Consumption and Capacity, by Prof. J. A. Hall of Brown University and B. P. Graves of the Brown & Sharpe Mfg. Co., was given by Prof. Hall. An abstract of it appears elsewhere in this issue. The discussion which was decidedly keen was participated in by Fred A. Parsons, Kempsmith Mfg. Co. (by letter), Carl Barth of Philadelphia, Prof. Airey and Carl J. Oxford of the National Twist Drill Tool Co.

Action of Milling Cutters

It will be remembered that Prof. Airey and Mr. Oxford presented a paper before the annual meeting of the A.S.M.E., in December, 1921, giving the results of their tests on the action of milling cutters. As their conclusions differed in some respects from those of the authors of the present paper the discussion was both interesting and valuable. As a matter of fact it was still going on in a corner of the lounge room of the club when the *American Machinist* representative left to catch his train.

The second paper of the afternoon was read by Geo. H. Benzon, Jr., engineer, William Sellers & Co., Inc., of Philadelphia. The subject was The Design and Construction of Large Machine Tools. As an abstract of this paper will be published in our issue of March 15th none of the details will be taken up here. Mr. Benzon showed some excellent slides of some of the big machine tools made by Sellers and brought out some of the problems in design that had to be solved in order that the machines should operate with the accuracy necessary.

More general topics were taken up in the papers presented at the evening session. Dean Dexter S. Kimball of Cornell, former president, A.S.M.E., spoke on the development of machine tools and the part they have played in our industrial development. Dean Kimball said:

"Back of the amazing array of productive tools and processes that now fill the land stands a group of tools that are in a class by themselves. These may be called the 'Master Tools of Industry' since the production of all other tools and processes, in the construction of which metal working is a necessity, depends upon the possession of some or all of these tools. This group consists of the lathe, the planer, the drilling machine, the boring mill, the milling machine and the grinding machine, with their several modifications and derivatives. They constitute the group commonly known as 'machine tools' and are familiar to all who are acquainted with machine production.

"The primitiveness and inaccuracy of the machine tools in use when Watt began to build his steam engines are almost unbelievable. We find him complaining of one of his steam cylinders that 'at the worst place the long diameter exceeds the short by three-eighths of an inch' and there is much other evidence that indicates similar crudity in all machine processes. The development from these crude beginnings to the modern standards of accuracy and output is something of which every engineer may well feel proud. It is difficult always to give due credit for great improvements in any line to all who have contributed to the accomplished result. Great inventions, so called, are usually the result of a long train of thought and experiment on the part of many men. But it is customary to give the greatest credit to the man who first makes a great idea a real working possibility. For this reason there are a few outstanding men among those who brought this great change about, though undoubtedly the ideas they put into practical working machines had occupied the minds of many of their predecessors. Wilkinson's boring machine solved Watt's difficulties so that Boulton writes of a fifty-inch cylinder that 'does not err the thickness of an old shilling in any part.' And there are many other names among these old pioneer English mechanics that should be held in everlasting remembrance when the names of all great warriors have been forgotten.

Outstanding Names in Machine Tool History

"There are, in the history of machine tool development, three names that stand out in bold relief. The first of these is Henry Maudslay, who was born in 1771. Until Maudslay's time the turning of metal had been accomplished by hand tools. Maudslay finished the sides of his lathe bed and mounted it upon a saddle exactly as used on modern lathes, this saddle carrying a cross-slide in which the tool was rigidly held. The saddle was actuated by a lead screw and change gears as in all modern lathes. Maudslay's improvements constituted a transfer of skill that did much to start the modern industrial era.

"The second great improvement in machine tools was the application of the turret to the slide rest so that a series of operations can be performed repeatedly without resetting the cutting tools. Here again we have an idea that was undoubtedly an old one; but it remained for an American, Henry David Stone, to make it a working possibility in the turret lathe built by him in 1858. Stone's first semi-automatic turret lathe carried four cutting tools on the cross-slide and six in the turret. His improvements rank in importance with those of Maudslay and they made possible most of the modern semi-automatic machine tools. Lastly came the invention of the universal cam or 'brain wheel' by another American, Christopher Mines Spencer, which provided an automatic control for the combination of Maudslay's slide rest and Stone's turret. This improvement made possible the modern automatic lathe and similar machines. It is a tribute to the genius of Spencer that his very first automatic machine was a great success. While he is known and remembered largely in connection with the invention and production of firearms, Spencer's greatest contribution to machine production is the universal cam wheel, a device which was never patented.

The Importance of Cams

"The importance of these inventions and improvements cannot be overestimated. The period of their development from Maudslay to Spencer was a little over one hundred years. These inventions with others of the same period embody the results of the observation, experience, and effort of the greatest group of mechanics in the history of the human race. Their achievements made possible the work of such men as Hartness, Swasey and other great builders and laid the foundation of modern industry and transportation. Selfishness, stupidity, and lack of knowledge have as yet stood in the path of the full realization of the benefits these inventions can bestow upon all humanity. It is to be hoped that a wiser generation will be able to solve the problem of distribution in such a manner as will permit the use of these modern productive methods to fill the land with plenty."

A short address was made by President John L. Harrington of the A.S.M.E., and the final paper was given by Ernest F. Du Brul, general manager of the National Machine Tool Builders Association, on Some Features of the Economic Situation of the Machine Tool Industry. Mr. Du Brul took the 1919 census of manufacturers and analyzed certain of the figures to show the relative positions of the machine tool builders and other American manufacturers.

His figures showed that the average machine tool shop is about four times as large as is the average shop of all industries. In proportion the machine tool builder pays his men better and gets along with a smaller supervising personnel. He also paid more than his share of Federal taxes no matter what figures are taken as a basis of calculations. Perhaps the most significant figures indicate that the machine tool builder added 262 per cent of utility to the material and fuel used per wage earner while the average of all industry was but 66 per cent.

Mr. Du Brul then went on to give

some of the management problems of the machine tool shops. He pointed out that the machine tool builder feels the stimulus of the rising tide of prosperity last and is among the first to be hit when a depression descends. With his product price reductions do not ordinarily stimulate sales for the reason that purchasers have no more use for idle machine tools than they have for coffins while they are alive. He closes his remarks by stating that, "the machine tool industry has an ethical standard—that simple one on which dependeth all the law and the profits—the golden rule. Through long years the leading machine tool builders have built up their business on that standard. The violation of the golden rule by some of their customers cost them a lot of money in the deflation of the last boom.

As a result of the depression of 1921 and 1922 close attention is being given to the economics of the industry and the nature of its demand. The machine tool builder is studying what to do and what not to do at various stages of his business cycle. In his mind he is correlating his shop as a part of the industry, and his industry as a part of the big industrial machine that turns out goods of all kinds for the world's comfort. Such correlation will make a better industry with sounder, saner conditions than the machine tool builder has ever known, either in booms or depressions.

Directors Are Elected for Billings & Spencer Co.

At the adjourned annual meeting of the Billings & Spencer Co., Hartford, Conn., held February 26 eleven directors were elected. The men who will serve on the board for the coming year are: Frederick C. Billings, Lucius F. Robinson, Samuel Ferguson, L. Edmund Zacher, Morgan G. Bulkeley, Jr., Charles D. Rice, David J. Post, Edward Milligan, Mitchell S. Little, John J. McKeon of New Haven and Henry M. Sperry. Most of the directors are newly elected and represent strong financial interests, according to reports.

It was decided at the meeting to issue seven per cent bonds to the amount of $600,000 to run for a period of ten years. Business, according to members of the directorate, has taken a decided advance since Jan. 1, and the additional capitalization is to be used in furthering production and to meet the demands of the consumers for the company's products.

Statement of Railway Steel Spring Company

By the report recently issued by the Railway Steel Spring Co., New York, the year 1922 shows a surplus after dividends of $302,293 as compared with a deficit of $473,365 for 1921. On December 31 the profit and loss surplus stood at $12,771,283 whereas on December 31, 1921, the same statement showed but $12,468,990. It was stated by F. F. Fitzpatrick, president of the company, that it had been decided for the purposes of economy to discontinue operations at the wheel works of the company and to manufacture the steel tired wheels at the tire mills.

Machine Tools in the Los Angeles District Total $2,500,000 a Year

IF LOS ANGELES is an average index of the Pacific Coast, there is certainly no cause to complain as to lack of business. Everyone is apparently busy in machine lines whether they are making oil burners, automobile pistons, oil well tools or parts which have to do with building construction. All this is of course reflected in the machine tool business of this section, every dealer reporting an increase of sales and a demand for early deliveries.

The most urgent demand undoubtedly comes from the oil well field, for wells are being driven with feverish haste, many of which are showing a remarkable production. The country for miles around is a forest of oil derricks such as we used to see only in Western Pennsylvania. And the oil is said to be of good quality.

In fact oil is the most prominent of the city's activities at present and you cannot walk along the principal streets without being solicited to take a free bus ride to, and get a free lunch at, some of the wonderful oil properties. Main street in particular has assumed many of the characteristics of Coney Island, with its barkers for all sorts of stock or land selling schemes. The "blue sky law" is being successfully eluded by selling "units," or sections of the oil properties, instead of stock, each unit being entitled to a share in the oil produced by the whole tract.

Machine Tools in the Oil Fields

This oil boom makes business in many directions and machine tools are getting a goodly share. Oil well tools are in great demand and the anxiety for immediate delivery gives an opportunity for charging almost any price. This has led to the establishment of a lot of small shops of various kinds, all needing machinery and all employing mechanics of one kind or another.

One unfortunate development of this is the demand for, and the extension of, extremely long credit. In one recent case a man wanted $20,000 worth of machine tools for $2,000, the balance on a year's time. In fact many try to buy on the basis of 10 per cent cash and a year for the balance. Some seem to get away with it. But it can be readily seen that the average machine tool dealer can hardly be expected to finance the various shops which spring up as the result of the oil boom. Especially when the history of all oil or other booms is that somewhere in the future a dull thud seems to be always lying in wait.

Building activities are going on at an enormous rate—not only in the city but in new suburbs, some of which are thirty miles out. Although the average dwelling in the suburbs is a pretty flimsy affair as viewed from eastern practice, it answers very well in this climate with the aid of a gas heater for chilly mornings and evenings during a short period. The city building is for the most part substantial, the new Biltmore hotel containing thousands of tons of steel, all fabricated by a local concern. Building materials and machinery are in great demand.

As before mentioned, all this reflects more or less directly on the machine tool business. And the volume of this machine tool business in the Los Angeles district is of much greater proportions than most of us realize. A canvass of the field, checked from several different angles, seems to show that machine tools aggregating $2,500,000 in a year can be credited to this district.

When we consider that this is largely made up of orders for individual machines, instead of lot orders as in manufacturing sections, it means even more than at first appears. Small shops, widely scattered, make an immense amount of traveling necessary and not only take time, but add to the selling cost. But a total business of two and a half millions is not to be sneezed at, and it would probably pay some of the builders of machine tools to get personally acquainted with this field.

Steel Castings Business Greatly Increased

Sales of commercial steel castings in January were the largest since March, 1920, according to reports received by the Department of Commerce through the Bureau of the Census, in co-operation with the Steel Founders' Society, from companies comprising over two-thirds of the commercial castings capacity of the United States.

Total bookings reported in January were 103,161 tons by firms with a capacity normally devoted to commercial castings of 96,200 tons, or at the rate of 107.2 per cent of capacity, as against December bookings at 71.1 per cent of capacity. Bookings of railway specialties amounted to 47,879 tons, or 125 per cent of capacity, as against 73.8 per cent for December bookings. Bookings of miscellaneous castings amounted to 55,282 tons, or 94.3 per cent of capacity, and the largest amount booked in any month since records are available, in January, 1920.

Exposition of Inventions

The First International Exposition of Inventions and Investments was held under the auspices of the Universal Patent Exposition Corporation, Feb. 16 to 23 at the Grand Central Palace, New York, N. Y. There were many exhibitions of inventions in all fields, a fair proportion of them relating to machinery and shop equipment.

The object of the exposition was to bring together inventors, manufacturers and business men. Inventors having worthwhile developments may thus be enabled to place them on the market. Also, they may learn from the promoters of inventions, along which line it is best to bend their efforts. From the viewpoint of the business man, the show was intended as a market-place for inventions, where devices suitable for manufacture and marketing can be found. It is the aim in holding the exposition to foster invention, and to encourage co-operation between inventors and parties who can utilize their inventions.

Business Items

The Lacey Manufacturing Co., punch press tools, special tools for all kinds of special machinery and small parts, is now located in its new factory, 715 Union Ave., Bridgeport, Conn.

The Triplex Machine Tool Corp., bench lathes, milling and drilling machines, has moved its office from 18 West 41st St. to 50 Church St., New York City.

The R. B. George Machinery Co. has leased for five years a two story building in Dallas, Texas.

For the year 1922, the Sullivan Machinery Co., Boston, shows net earnings of $1,428,746 as compared with $872,871 earned in 1921. After reserves, depreciation and dividends there remained a surplus of $421,901 as compared with a deficit of $37,000 for 1921.

The Cassady-Grey Granite Co., Llano, Texas, recently received six car loads of machinery for its new Ledgewood cableway at its quarry.

The Pennsylvania Electric Steel Co. has taken over the Driscoll-Rees Steel Co., Hamburg, Pa., and it will be put into operation within a few weeks. A new process high grade tool steel will be made.

The Southern Railway has placed an order for sixty-six locomotives with the American Locomotive Co. The expenditure is estimated at approximately $3,700,000 and the construction work will be done at Richmond, Va.

The Columbus Machine Co., Columbus, Ohio, recently reorganized with a capital stock of $300,000.

The Porter-Cable Machine Co., Syracuse, N. Y., has taken over the line of sanding machines of the Syracuse Sander Manufacturing Co. and is manufacturing this line in addition to its other products. It was erroneously stated last week that the Portable Cable Machine Co. had succeeded to the Syracuse Sander Manufacturing Co.

The Holyoke Water Power Co., Holyoke, Mass., is about to install a new steam turbine at its power plant on the Connecticut River bank. It will have a capacity of 7,500 kilowatts. The General Electric Co. has been awarded the contract. This installation is to conform to plans pursued in the remodelling of the plant some months ago.

Damage to the amount of $150,000 was done recently by a fire at the plant of the National Hame & Chain Co., Albany, N. Y.

Saw mill parts and castings are to be manufactured in the new plant of the C. H. Turner Foundry Co., Inc., now being constructed at Statesville, N. C., according to C. H. Turner, president of the company. This concern was recently formed with $100,000 capital under the North Carolina laws.

The Eastern Steel Castings Co. has acquired the property of the Bayonne Steel Castings Co., Bayonne, N. J. The Eastern, which is controlled by the American Brake Shoe & Foundry Co., now has a capacity of 1,200 tons a month. The company makes open hearth and electric steel castings, that are sold to machinery makers, steam and electric railways, electrical and oil companies, shipyards and powerplants.

A new addition to the plant of the Acme Steel Goods Co., Chicago, is being built at Riverdale. The addition will contain two cold-rolling mills and a warehouse. When completed it is expected that an additional force of 250 men will be employed.

A department for the manufacture of piston rods and one for small finished work have been installed by the Titusville Forge Co., Titusville, Pa.

The Springfield Iron Works, Springfield, Mass., acquired recently by John E. Broberg and August Beckman, is about to erect a building 50x30 ft. for use in building and repairing elevators of the electrical and plunger types.

The E. M. Harper Tool & Supply Co., New York, has combined with the Aborn Steel Co. and will henceforth be known as the Aborn-Harper Steel & Engineering Corp.

A new factory is being built by the Spartan Saw Works, Springfield, Mass. Joseph H. McQuillan and Harold F. Stout are the owners of the works.

The Western Iron Stores Co., Milwaukee, Wis., has been appointed distributor for Milwaukee for the Garvin Machine Co., New York.

Personals

ANDRE CITROEN, automobile manufacturer of Paris, will visit the United States during this month or in April. Citroen automobiles equipped with caterpillar propelling arrangement in place of the rear wheels have proved a success and are being built by the French factory.

F. M. LUCHS, formerly chief engineer for the Gibb Instrument Co., Bay City, Mich., electric equipment, is in charge of the recently opened sales office of the company located in the General Motors Building, Detroit.

W. H. BARR, president of the National Founders' Association, Chicago, has been appointed on the newly created advisory committee of the A.E.S.C.

J. K. CULLEN, president of the Niles-Bement-Pond Co., New York, has been appointed on the advisory committee of the A.E.S.C.

HENRY D. SHARPE, treasurer of the Brown & Sharpe Manufacturing Co., Providence, R. I., is a member of the new advisory committee of the A.E.S.C.

L. W. WALLACE, executive secretary of the Federated American Engineering Societies, has been re-elected presidnt of the Eyesight Conservation Council of America.

E. A. HARPER has been elected president of the Aborn-Harper Steel & Engineering Corp. with offices at 22-24 Clarke Street, New York City.

E. JULLIEN, engineer for Andre Citroen, automobile manufacturer of Paris, will arrive in the United States on the next arrival of the S. S. France which left France on March 3. He will visit several factories while in the United States.

FRED D. MARSHALL will have charge of the Columbia, S. C., branch of the Austin Machinery Co. of Toledo, Ohio.

RICHARD W. CROCKER, associated with the Boston office of Manning, Maxwell & Moore, has resigned to become New England representative of the Clark Equipment Co., drills, of Buchanan, Mich.

Charles J. Schmid has been appointed manager of sales for New York City and Long Island for the Uehling Instrument Co., Paterson, N. J., power plant gages. Mr. Schmid was formerly in charge of the Boston office for the company.

MERVIN KESSLER has been appointed general manager of the Athol Machine Co. to succeed H. R. Linton, resigned. Since 1919, Mr. Kessler has been superintendent of that plant. He was formerly with A. E. Meyers & Co. and the Standard Steel Car Co., Pittsburg.

HAROLD PRIGOFF, for the past four years sales manager for the Syracuse Supply Co., Buffalo, N. Y., has resigned to accept the position as Eastern sales manager for the Gardner Machine Co., New York City.

Obituary

HENRY E. GOODELL, for many years a manufacturer of tools and hardware specialties, died in his home in Greenfield, Mass., Feb. 23, at the age of 77 years. He was born in Whitingham, Vt. With Albert D. Goodell he engaged in the manufacture of hardware under the name of Goodell Bros. at Shelburne Falls and Greenfield, and in 1893 founded the establishment now conducted as the Goodell-Pratt Company. Later in association with his son-in-law, Perley E. Fay, he established the Goodell Manufacturing Co., in Greenfield, which Mr. Fay now manages.

DELEVAN M. FOX, for many years the superintendent of the pattern department of the Bagley & Sewall Co., paper machine manufacturers, died at his home in Watertown, N. Y., recently, aged 74 years.

ALTON N. BATES, vice-president and general manager, Erie Foundry Co., died recently at his home, Erie, Pa.

Westinghouse Leases Twelve Floors in New York

The Westinghouse Electric & Manufacturing Co. has leased for a period of ten years, twelve floors in the new bank and office building which is to be erected at 150 Broadway, New York City. The new building is to be known as the Westinghouse Building and in addition to the offices of the Westinghouse Electric & Manufacturing Co., space will be occupied by the Westinghouse Electric International Co., the Westinghouse Lamp Co., the Westinghouse Air Brake Co. and other companies that are affiliated with the Westinghouse Electric & Manufacturing Co.

The building is owned by the 150 Broadway Corporation of which Fred T. Ley is the principal stockholder. The Westinghouse offices at the present and until the new building is completed will be at 165 Broadway.

Reeves Predicts Lighter Auto Engines

Improvement in transmissions, spring suspension, the introduction of lighter and more economical engines and the uses of lighter metals, are practically the only improvements to be made in automobiles for some little time, according to Alfred Reeves, general manager of the National Automobile Chamber of Commerce in a speech delivered at the West Side Y. M. C. A., Feb. 28. Mr. Reeves took as his topic "The Outlook for the Automobile Industry in 1923." He stated that the saturation point was far from being reached and that in many cases buying had just begun. While there were made and sold last year over two million automobiles of all classes, he stated that the plans and estimates for 1923 included the manufacture of over three millions.

"All of the improvements in transportation have taken place within the past one hundred and twenty years," Mr. Reeves stated. "From the commencement of Christianity down to the American Revolution and past that date the mode of travel was practically the same. It was not until the invention of the steam boat that strides were made in the greatest aid to civilization—means of travel. The automobile has seen many changes since it was first invented and at the present time standardization is the one thing which is being perfected. We have now about 114 parts of the automobile standardized and more will follow.

"Bus transportation is another phase of the industry that has become a big factor in our every-day lives. Railroads are the logical people to handle this mode of transportation and many of them are taking the proposition up on the short lines of the roads. They are able to deliver to your door the freight from neighboring points at the one freight rate. This means greater economy to the consumers. Highways are a problem which we are working hard with. It is up to all of us to see that the money appropriated by the Government actually goes toward the building and maintenance of highways.

"The mania for speed is over and manufacturers are turning toward engines that are lighter and therefore consume less gas and for bodies that are constructed of metals that are less heavy and cumbersome. There has been no improvement in transmission in some time and this must be worked out by engineers."

Henry Dreses Retires from Active Business

Henry Dreses, president and general manager of the Dreses Machine Tool Co., Cincinnati, Ohio, has retired from active business after fifty-four years as a prominent figure in the machine tool industry. William Gilbert, his partner for many years, has purchased the interest of Mr. Dreses and will organize a stock company that will continue the business under the same name.

Mr. Dreses was born in a small town in Germany which he left while still a boy and journeyed to a larger town where he hired out as an apprentice in a small machine shop. Following a short time here he pursued his trade in France and England, the meanwhile studying mechanical engineering.

After his arrival in the United States he secured a position with the Lodge & Davis Machine Tool Co., Cincinnati, and through study and application became the chief designer for this concern.

After serving with this company for a number of years he formed a partnership with William Gilbert, Oscar Mueller and Charles Lange under the name of Dreses-Mueller & Co. The business venture proved to be an unqualified success and within a few years Mr. Dreses and Mr. Gilbert bought out the

HENRY DRESES

other partners and continued the business under the name of the Dreses Machine Tool Co., manufacturing radial drills. The product is known in every part of the world today.

Mr. Dreses will take a much needed and well earned vacation and rest, completely free from business cares. He is one of the best known and most highly respected men in the machine tool business and the good wishes of the entire industry go forward to him.

Important Improvements for Southwest Planned

It is expected that within a few months the seven states in the southwest effected will ratify the compact that has been outlined by the Colorado River Commission. After considerable time and study the Commission has concluded that by the construction of dams and other means of checking flood problems, an area of 242,000 sq.mi. can be developed and that that portion of the United States can be populated to the benefit of each of the states involved and to the United States in general.

To accomplish this work it would be necessary, according to a recent report of the Commission, to purchase considerable equipment including steam shovels, stone crushers, screens, hoists and derricks, pumps, locomotives, dump cars, drilling and power equipment, reinforcing bars, rails for temporary tracks, steel screens and gates, structural steel and galvanized sheeting.

The states that would be effected are: Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming.

Farm Machinery Exports In 1922

In 1922, according to *Commerce Reports*, issued by the Bureau of Foreign and Domestic Commerce, 10 countries took 85 per cent of the American exports of agricultural implements and machinery, as follows: Canada, $9,440,084; Argentina, $5,360,845; France, $3,918,377; Mexico, $1,781,979; Australia, $1,298,704; United Kingdom, $1,115,816; British South Africa, $697,371; Cuba, $410,433; Spain, $396,587; and Brazil, $394,843. The first three countries occupied the same relative positions in 1922 as they did in 1921. Canada also occupied first place in 1920, with France second and Argentina third, while in 1919 France held first place, followed by Canada and Argentina.

Our total exports of agricultural implements and machinery to Canada in 1922 showed an increase of more than $1,000,000 over those of 1921. American exports to Mexico and Brazil also increased, while those to the other seven countries mentioned above decreased in 1922, as compared with 1921. The 1922 figures, however, are not absolutely comparable with those for 1921, as in the statistics for the later year are included such items as dairy machinery, incubators and brooders, hand pumps, and one or two other items which are not included under agricultural machinery in other years. These additional items increase the total of exports by about $5,000,000.

The principal exports to Canada were tractors and threshers with plows, harrows, harvesting machines, cream separators and pumps also included. Argentina bought plows, threshers, harvesters and reapers mostly, while France purchased harvesters and reapers, mowers, pumps, and tractors. The United Kingdom took cultivating and harvesting implements, pumps, wheel tractors and track-laying tractors. Mexico bought wagons and drays, some pumps and a few plows, harvesting and cultivating machines and tractors.

Australia took generally of all classes of agricultural machinery with tractors a trifle in the lead. South Africa took no tractors at all, but windmills to great number and some pumps were bought by this country. The exports of agricultural machinery to Cuba, Spain and Brazil were rather evenly divided.

Sharon Pressed Steel Will Continue Business

The Sharon Pressed Steel Co. was placed in the hands of receivers through an order recently signed by Federal Judge Gibson of Pittsburgh, upon application of Charles J. Forbes of Cleveland, who claimed to hold a note for $300,000 against the company. According to reports, the company will continue operations under the receivers who are Donald Thompson, Pittsburgh and W. L. David, Cleveland.

The financial difficulties encountered by the Sharon Steel Co. were the result of those that were encountered by the Cleveland Discount Co. H. W. Torney, president of the Sharon Steel Co. stated that the assets exceeded the liabilities. The company has on its books orders for more than $750,000 according to Mr. Forbes' petition.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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IT HAS BEEN unofficially but none the less definitely made known that the advance to 4½ per cent in their rediscount rates announced last week by the Federal Reserve Banks in New York and Boston was designed to check what is called inflation, and especially the sort of inflation that fosters the speculative buying of securities and staple commodities.

The issue is therefore joined. It remains to be seen whether the conservatism of the bankers can prevail over the desire to buy inspired by advancing prices.

For a few days after the advance in rates was announced the markets were reactionary, but by Tuesday they had commenced to recover their previous buoyancy. Stocks started up again. Cotton futures reached and passed 30 cents. Copper touched 17 cents. Zinc sold at 7.65 cents, the highest price since October, 1920. Tin went to 45 cents a pound, which is a record since September 1920, and iron and steel are up from $2 to $5 a ton with the whole industry working at 90 per cent of capacity, while would-be buyers are begging the manufacturers to accept their orders.

In the wholesale and jobbing trade February is traditionally a "between seasons" month, but the demand for merchandise has nevertheless been excellent and it would appear that the confidence in the future which I noticed in the West will be reflected in an unusually good spring business.

In view of this record there seems reason to doubt whether the higher interest rates will immediately check or reverse the upward tendency of prices, and now that the first shock of the unexpected advance has passed off many are saying that dear money is always a concomitant of good times and that when business is profitable no one begrudges paying well for the credit he requires.

Of course the banks can ultimately restrain the uprush of prices by persistently advancing the cost of borrowed capital, but even the Federal Reserve Board must reckon with public opinion and unless the reserve ratio falls below 50 per cent there is but little likelihood that the Federal Reserve authorities will be allowed to lift the rediscount rate to a figure that would mean more than 6 per cent to the ultimate borrower.

The effect of the advance in the rediscount rates established last week is apparent in the week-end statements of the Federal Reserve System, which show a reduction in both discounts and circulation, and an advance in the reserve ratio, which now stands at 76.2 as against 75.8 per cent a week ago. The reserve ratio of the New York Bank in particular has risen from 79 per cent to 80.6 per cent. These figures indicate a contraction rather than an expansion of credit, and upon second thought the business community seems disposed to assume that there will be no curtailment of business activity as a result of higher interest rates provided they do not go beyond 6 per cent, which appears highly improbable at present.

Therefore with the adjournment of Congress and the President's assurance that he will not call a special session if he can avoid it, there is every reason to hope that we shall have a summer of very satisfactory business unless prices go so high that they incite a buyers' strike or the Franco-German stalemate in the Ruhr develops menacingly.

> "It is gratifying to observe that the condition of the railways is greatly improved. January earnings show a substantial gain over last year and M. O. Lorenz, the statistician of the Interstate Commerce Commission, is quoted as intimating that the net revenues of the current year may be large enough to show 5¾ per cent earned on $19,400,000,000, which is tentatively assumed to be the present value of Class 1 railroads."

The last possibility is not, however, to be disregarded. The most reliable news indicates that the French are not getting one-tenth of the coal that was delivered to them free before the occupation. Thus far they have made but little progress in breaking down the passive resistance of the Germans, and arrests, deportations and imprisonment, with occasional fatalities, multiply. It seems impossible to find competent French and Belgian workers to man or supervise the industries of the occupied area and the result is confusion, stagnation and bad blood at a cost enormously in excess of the value of the expropriated production.

It seems impossible that the ignition of so much inflammable material can be much longer prevented, and from motives of self interest alone it is highly desirable that the other nations of the world should arrange to have some fire extinguishers at hand. For this reason it is to be regretted that President Harding's proposal that we should join the League of Nations Court of Justice was made too late to be considered by the Senate, for it certainly reflects the preponderance of American opinion at the moment.

In its other aspects, the outlook across the Atlantic is more reassuring. The deliberation with which the Turkish assembly at Angora is considering the British proposals indicates a desire for peace, and conditions in Austria and Italy are certainly improving.

From Russia, also, the reports are more encouraging and, though they are not authoritative, I am disposed to credit them as I have personal knowledge of the fact that Russia has recently bought and paid for 20,000 bales of American cotton.

Turning again to our domestic situation, it is gratifying to observe that the condition of the railways is greatly improved. January earnings show a substantial gain over last year and M. O. Lorenz, the statistician of the Interstate Commerce Commission, is quoted as intimating that the net revenues of the current year may be large enough to show 5¾ per cent earned on $19,400,000,000, which is tentatively assumed to be the present value of the "Class I" railroads. This expectation has been reflected in a stronger market for the railway shares, although railroad bonds in common with "Libertys" and all other obligations paying a fixed return are slightly lower because of the advance in interest rates.

The probability that Congress will pass the Rural Credits Bill before it adjourns is also encouraging, for while loans are not a satisfactory substitute for markets they will greatly aid in the stabilization of prices if they are not excessive. The bill as now agreed upon and likely to pass creates 12 district banks with a capital of $5,000,000 each, through which an aggregate of possibly six hundred millions in loans can probably be floated if necessary. This will not go very far in a country whose agricultural production is worth from ten to fifteen billions annually, but it will be a good commencement.

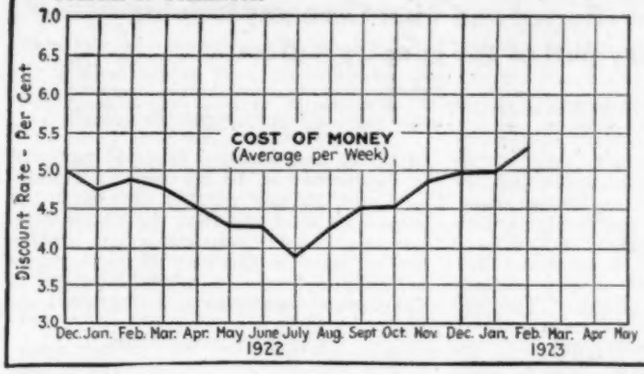
The only question is that of finding the capital to be loaned through the machinery thus provided. It can no longer be obtained in Europe as formerly. It must be secured at home and with the continued borrowing of our states and cities the competition in the money market may soon become very keen.

But those who are willing to borrow money seem disinclined to borrow trouble concurrently, and barring accidents a continuance of activity at gradually advancing prices appears to be indicated as long as the supply of loanable credit holds out.

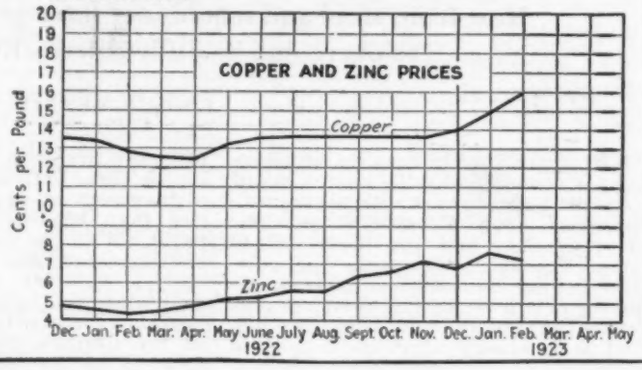
To Sell Plant at Auction

Judge Simons in Federal Court, Detroit, ordered the property and good will of the Liberty Motor Car Co. sold at public auction on April 3. The minimum accepted bid will be $1,175,000, according to the court order. The property consists of real estate both in Detroit and Milwaukee.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



THE COST OF MONEY has shown an increase by the latest reports and there is every indication that it may go still higher which is always the attendant condition with prosperity. Sums are needed at the present time for new equipment, building purposes and many other first of the year necessities. The purchasing of bonds by banks has caused the Federal Reserve Banks to raise the rediscount cost and financial experts generally look for slight increases in both call and time loans.

Cotton Spindles reached their peak of activity in January this year. During the month, 35,240,853 spindles were reported working, which is a remarkable figure and one which has not been reached in some time. The cotton market generally has been extremely active for the past few months and according to the chart shown on this page the capacity point was nearly reached. Capacity is estimated by the Bureau of Census at 36,903,150 spindles. In the woolen and worsted trades slight decreases, mostly of a seasonal nature, occurred. In both branches of the industry activity is considered to be normal and no alarm is felt by the decline. On the contrary, prices have been well maintained and trading is brisk for this time of the year.

Copper and zinc prices during the past month have been interestingly watched by manufacturers in all parts of the country. Copper reached 16.75 cents before March 3rd and since that time has added a fraction more to its price. It is not unlikely that between the time this is written and the time that it is read a further gain will be made in this commodity. Anticipation of still higher prices has caused some consumers to buy more than their present actual needs which has also been a factor in the increases. The demand is founded upon a substantial basis from consumers and through no trick of the market. Zinc has been more steady and was obtainable at 7.30 cents during the month. Business is reported as excellent at this figure. Advances were made during the first week in March until the quotation was 7.60 cents for May, June and July shipments.

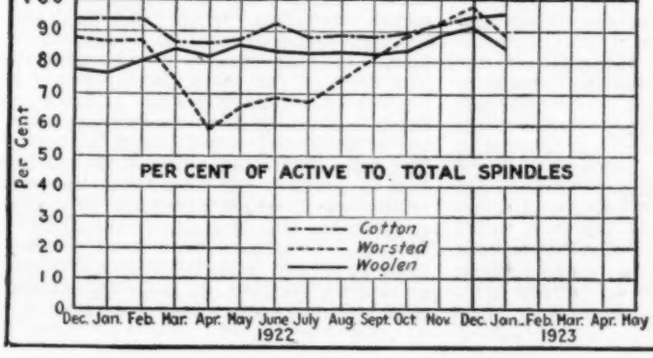
Ten Equipment Stocks during the month of February showed an increase which is encouraging, but nothing to become over-elated about. A casual glance at the chart shows that in September, December and at the present date an average around 110 has been reached by the stocks which are quoted on this page. Manufacturers look for further gains in all equipment stocks, but it is not anticipated that there will be a generally rising market, rather a steady normal increase as business takes on a better face and money is more freely circulated. The amounts that are being spent by railroads in every part of the country presage equipment buying in all lines and the present excellent condition of the iron and steel markets will further aid substantial business in all lines of manufacture essential to industrial prosperity.

Comparative Prices of Shop Supplies

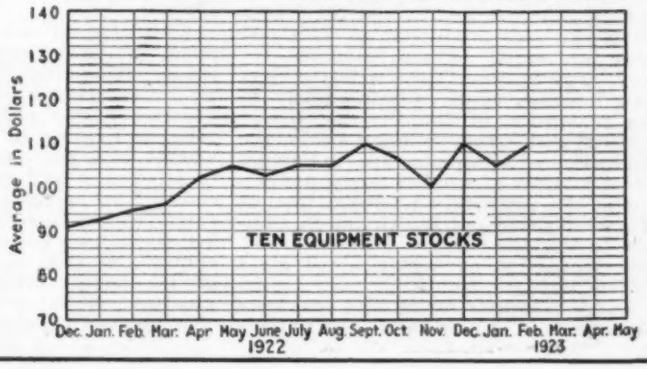
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0312	$0.0303	$0.0247
Cold finished shafting	per lb	0.0402	0.0383	0.0330
Brass rods	per lb	0.1804	0.1766	0.15
Solder (½ and ½)	per lb	0.2617	0.2508	0.20
Cotton waste	per lb.	0.1181	0.1181	0.106
Washers, cast iron (⅛ in.)	per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	2.96	2.96	3.11
Lard cutting oil	per gal.	0.5575	0.575	0.57
Machine oil	per gal.	0.349	0.349	0.40
Belting, leather, medium	off list	49%	49%	46¾%
Machine bolts up to 1 x 30 in.	off list	51½%	51½%	64⅔%

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Ruhr Occupation and German Machine Tools

How iron, steel and machinery have been effected and what Germany is doing to overcome its difficulties—Every part of the country suffers

By OUR BERLIN CORRESPONDENT

THE GERMAN business situation is dominated by the occupation of the Ruhr district with all the consequences upon Germany's economic life it already had and those still to come. Transportation in the Ruhr district having become disorganized, resulting in a more or less complete congestion on the railway lines, the district is gradually arriving in a state of isolation. The Ruhr district is provided with a most intricate net work of railway lines, no doubt the most densely covered district of Europe, which, if once blocked, will take many weeks to disentangle. After last year's railroad strike, which lasted only a few days, a complete recovery to normal conditions was not reached until after from five to six weeks.

Long Siege Ahead

The industrial establishments of the Ruhr district are cut off from their markets, a state of affairs, which is bound to extend over months. Work, is, however, continued in the interest of keeping the workmen employed. Orders in hand are being completed. The finished product is stored. Coal production is going on at a reduced rate, estimated at 270,000 tons per day compared with 350,000 tons normally. Shipments of coal out of the Ruhr district having stopped almost completely, the large steel works in the district and all the other numerous industrial establishments are now able since years to lay in a large stock of coal reserves.

A similar accumulation of reserves is taking place in the matter of iron and steel products. At no time since the war have the works in the Ruhr district enjoyed more favorable conditions in the matter of supply than now. As long as this huge accumulation of reserves in stock can be financed, no unemployment on a large scale in the Ruhr district need be apprehended.

The Other Parts of Germany

The shoe is indeed quite on the other foot. If unemployment results as a consequence of the Ruhr occupation, it will be in the unoccupied interior of Germany and, if the old occupied zones remain cut off from the Ruhr district, also in the latter. Rhineland on the left bank to the Rhine has to fall back upon the output of bituminous coal in the lower Rhineland of approximately 500,000 tons per month and the Rhenish brown coal production of 3,300,000 tons per month. These resources are very large in comparison with the German interior, which remains solely in the possession of the German Upper Silesian and Lower Silesian fields, the production of bituminous coal in Saxony and a number of smaller fields, producing in the aggregate 1,700,000 tons of bituminous coal per month and in addition to this the Central German brown coal production averaging about eight million tons per month.

Large contracts for British coal have already been placed and negotiations for more are in progress. As far as can be seen, Germany is preparing for a drawn-out struggle of longer duration than has been commonly anticipated. With the resources still in hand and increased imports from Great Britain, a sufficient coal supply can be maintained for many months. The coal import will be a further heavy strain on the German finances, but the cost appears to be covered many times over by the export proceeds of finished articles.

Great difficulties are presented from another direction: the supply of iron and steel products. The Ruhr district contributes to the German iron and steel production about 80 per cent, whereas it consumes approximately 40 per cent. The deficit of 40 per cent resulting therefrom to the German interior will have to be made up by a supply from Sweden, Checho-Slovakia and Austria, where large orders have already been placed, but it is more than doubtful, if it can be covered in its entirety from these sources.

Of all lines of industry the machine building industry and kindred lines are placed in the worst position. The process of substitution from other sources is in this respect of course not so easy as in the matter of coal. Considerable friction in the supply must be counted with, even if the supply in sufficient quantities can be secured.

Decline in Production

The immediate demand is covered by stock in hand for about 4 or 5 weeks, but beyond that period the most extreme difficulties will be encountered by the machine building works in keeping up their production at the present rate. It is commonly expected that this rate will have to be reduced considerably, which is bound to precipitate the decline of employment prevailing already. That this decline has not made further progress in December and January and has even been superceded in places by a revival of business, is solely due to the tremendous drop of the mark, causing a rush of orders for immediate demand, and to the expected consequences of the Ruhr occupation. That such revival, as there was, is of a temporary nature only, can be clearly seen from the fact, that it did not extend over the whole field, but only over such lines, which in the common expectation will be nearest effected.

According to the official labor gazette, the unemployment in the metal trades, consisting in the main of the machine building industry, which in September was only 2 per cent, has risen in October to 5 per cent, in November to 6 per cent and in December to 8 per cent and in January to 9 per cent. The percentage of works fully employed has from November to December risen from 33 to 35 per cent, but a similar rise took place also in the case of the badly employed works, whose number rose from 23 to 25 per cent. The number of works employed satisfactorily has declined from 44 per cent in November to 40 per cent in December and 36 per cent in January. It appears therefrom that the upper categories, mainly consisting of leading works, have in the way of employment still made progress, while business in the lower categories has regraded.

Export Competition

Indications of a decline are noticeable in the reports received at the national economic ministry, in all parts of the country. Common in all these reports is the growing reserve of the domestic market and sharp competition in the matter of export orders, the export prices, it is said, having reached, even surpassed the world market level. With the exception of the South German motor car industry, all machine building lines report a decline of business. In the machine tool building industry, orders in hand have diminished to from two to three months employment in the average. New orders are coming in sluggishly and according to a number of reports cancellation of orders already booked have made rather strong progress. A further agravation of the business situation has resulted from the cancellation of the reparations in kind, which, if they had not taken large dimensions, have recently contributed a not inconsiderable part to the business in hand. In machine building lines, the locomotive and railway car industry is thereby effected most. Some factories have retained their complement of workmen solely on this score. A large contract for over 500 engines, recently placed by way of reparations, expected to supply employment to the works for several months, has dropped into the pit.

Apart from the events in the Ruhr district, the current year was according to common opinion predicted to be a far from a prosperous one. As it seems now, it will bring hardship of a much more severe and extensive nature, as even the gloomiest prophesy opinioned.

A Test of Perseverance

The supply from the basic industries being removed into the atmosphere of the greatest uncertainty conceivable, in addition to the yet unknown further developments in the German West, are reducing the industry to a from hand to mouth condition, which will tax the German engineer and business man's power of perseverance to the utmost. The drop of the mark has produced a further enormous shrinkage of working capital, straining the financial situation to a limit not experienced hitherto. The sole alleviating point in the situation is perhaps the fact, that the patriotic wave, which has gone over the country for the time being, had the effect of letting the latent labor conflict come to a rest, bringing employers and employees together on common ground in a way not experienced since years.

Book Reviews

Sampling and Analysis of Coal, Coke and By-Products—By the Chemists of the United States Steel Corporation. One hundred eighty-four 5x7¼ in. pages, black flexible covers. Published by the Bureau of Instruction, Carnegie Steel Co., Pittsburgh, Pa. Price $3.

While this book appears as a second edition of a former one, it really is equivalent to an entirely new work. Not only has all the old material been carefully re-edited and revised so as to bring all the former described methods up-to-date, but a great many methods and tests not covered by the former work are included in the new. The amount of new material is indicated by the fact that the present edition is more than double the size of the first one.

The work naturally divides itself into two parts, namely, one covering the sampling and analysis of coal and coke, and the other the sampling and analysis of by-products. The first part embraces the sampling of coal and coke, physical tests on coal and coke, the proximate analysis of coal and coke, the analysis of coal and coke ash, the ultimate analysis of coal, determination of the calorific value of coal and coke, and the determination of coke and by-product yields from coal. The second part covers in detail the sampling and analysis of ammonia liquors and still waste; sulphuric acid, lime and saturator liquor; ammonium sulphate and ammonium chloride; coal tar and naphthalene; benzol, toluol, xylol, and solvent naphtha, benzolated and debenzolated wash oils; and coke oven gas.

The new features, that is, those not touched upon in the older work, embrace details for sampling by-product coke; physical testing of coke; determination of the different forms of sulphur in coal; fusibility of coal and coke ash; analysis of ammonium chloride; a method for calibrating thermometers, complete specifications for thermometers used for testing liquid by-products; many additional tests for benzol products and tar, such as cloud test, pour or cold test, freezing point tests, specific heat, corrosion tests, etc.; wash tests for agitator products; and several tables covering gravities, weights and equivalents of sulphuric acid and aqua ammonia, and the conversion factors used in by-product laboratories.

Among the many improvements made in the methods formerly described, the most notable are a freezing method for the determination of light oil in the progressive distillation of coal, details for conducting distillation tests on each of the benzol products, and an improved apparatus for the determination of light oil in benzolated wash oil.

Machinery Foundations and Erection. Edited by Terrell Croft, Consulting Engineer, St. Louis, Mo. First edition, green clothboard covers, 6x8 inches, 691 pages, 773 illustrations. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price, $5.

The thoroughness of the treatment and the practical usefulness of the material in the book are probably the most noticeable features of the volume. The book should prove of value to those persons interested in the design or construction of foundations for machinery and in the erection of machinery, as practically the entire field is covered.

Much of the material in the book has appeared previously in technical periodicals, the articles being written from time to time by the editor of the volume. Other parts of it, however, have been supplied by individuals and by concerns specializing in the subjects treated. The work was prompted, the author states, by the dearth of practical and easily available literature on the subject of foundations. The volume certainly can be commended as accomplishing its purpose, as it gives a great variety and amount of data and information in a form in which it is easily available and usable. The chapters are broken into very short sub-divisions to aid in finding the desired material. Illustrations are profusely used. The treatment is such that the book can serve as either a text for class instruction or a reference volume.

A number of fundamental formulas have been developed to determine points of design of safe foundations. However, plain and simple rules are given whereby foundations can be properly designed by those having a working knowledge of arithmetic. Examples worked out numerically to illustrate the application of the rules are given throughout the text. At the ends of divisions there are questions and problems relating to the subject matter, the problems being solved in the appendix.

The first division of the book is devoted to the general requirements of foundations, to formulas for proper proportions, and to the subjects of vibration and the bearing power of soils. Then come divisions on the design and properties of machinery-foundation components such as anchor bolts, anchors and anchor plates, anchor-plate pockets, anchor-bolt casings, and anchor-bolt templets. Foundation installation is then treated under the subjects of laying out and excavating, masonry and concrete foundations and forms therefor, and lastly, enlarging, repairing and removing existing foundations.

The next group of divisions gives specific information on the design and construction of foundations for machines of certain types. The divisions take up the following machines: Steam engines and other reciprocating machines, steam turbines, steam boilers, waterwheels, electrical machinery, forging hammers and planers. The last divisions explain the methods employed in erecting the machinery after the foundation has been built, covering the subjects of drilling anchor-bolt holes in machinery foundations, erection of machinery, installing anchor bolts in heavy machinery foundations, and grouting machinery bedplates.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machines for casting under pressure small parts of delicate machines such as instruments of precision. Switzerland. Purchase. Quotations, c.i.f. Havre or Geneva. Correspondence, French. Reference No. 5514.

Machinery for making wax candles with a total capacity of about 24 gross per day of various lengths and diameters. Straits Settlements. Purchase. Quotations, c.i.f. Straits Settlements. Reference No. 5516.

Machinery and instruments for voice and sound reproduction, such as microphones dictaphones, acousticons and magnaphones, wireless telephones, apparatus and materials, phonographs and parts and phonograph-record manufacturing materials and machinery. Japan. Agency and purchase. Quotations c.i.f. Nagoya or Kobe. Terms, Cash. Reference No. 5517.

Circular shearing machine, swan neck or serpentine type, capable of shearing plates ⅝ in. thick. France. Purchase. Quotations, c.i.f. Havre. Correspondence, French. Reference No. 5526.

Coffee roasting machinery. Brazil. Purchase. Quotations, f.o.b. New York. Catalogs and descriptive literature desired. Reference No. 5527.

Machinery for sewing filled sacks. Spain. Purchase and agency. Correspondence, Spanish. Reference No. 5529.

Machines capable of punching holes from 5 to 25 millimeters and from 10 to 20 millimeters in diameter at any desired interval in rubber strips ⅝ in. thick. France. Purchase. Quotations, c.i.f. French port. Correspondence, French. Reference No. 5531.

Labeling machines for wine bottles. France. Purchase and agency. Quotations c.i.f. French port with customs charges included. Terms, payment against documents. Correspondence, French. Reference No. 5532.

Machines for fastening iron binding hoops on sardine packing cases. Spain. Purchase and agency. Quotations, c.i.f. Spanish port. Terms, payment against documents on delivery of machinery. Reference No. 5535.

Pumping machinery for water supply from river, two centrifugal electrically driven pumps, capable of delivering a minimum of 5,000 gallons of water to tank above main building against a head of 150 feet, through a 3 in. pipe about 600 feet long; two electric motors to drive the pump under the above conditions, allowing a maximum of about four to six hours to do the specified work; pumps to be of 110-volt alternating current, single phase to go on the same circuit as the lighting load and work during the day as not to interfere with the lighting at night, and from 700 to 800 feet of galvanized iron pipe and fittings ells, tees and valves. China. Purchase. Quotations f.o.b. American port. Payment, letter of credit and cash against document through bank. Reference No. 5540.

Machinery for manufacturing files. France. Purchase. Quotations, c.i.f. French port. Correspondence, French. Reference No. 5556.

Marble and stone-cutting machinery. Brazil. Purchase. Catalogs requested. Correspondence, Portuguese. Reference No. 5571.

Sheet-metal stamping machines and metal-embossing machines. Brazil. Purchase. Quotations, c.i.f. Brazilian port. Correspondence, Portuguese. Catalogs desired. Reference No. 5578.

Names and addresses of the following merchants will be forwarded upon request to the Philadelphia Commercial Museum, 34th below Spruce Street, Philadelphia, Pa. Requests should be made by number.

Paint machinery, ice-making machinery and refrigerating machinery. Singapore, Straits Settlements. Correspondence English. Reference No.10532.

Machinery for vulcanizing plant for the manufacture of vulcanite articles for magneto. India. Reference, No. 40,538

Can-opening machines that work on the ratchet principle. Agency. Australia. Reference No. 40,541.

Knitting machinery, shoe machinery. Virgin Islands. Reference No. 40,542.

Machinery and tools for making glass bottles. Correspondence in English. China. Reference No. 40,544.

Forthcoming Meetings

International Chamber of Commerce. Second general meeting, Rome, March 18 to 24. Julius Barnes, President of the United States Chamber of Commerce will head the American delegation.

National Metal Trades Association. Twenty-fifth annual convention to be held at Hotel Astor, New York City, April 18 and 19. L. W. Fischer, secretary.

Society of Industrial Engineers, Spring convention at Hotel Gibson, Cincinnati, Ohio, April 18 to 20. Secretary, George C. Dent, 327 South La Salle St., Chicago, Ill.

American Gear Manufacturers' Association. Seventh annual meeting April 19, 20 and 21, Hotel Cleveland, Cleveland, Ohio.

National Foreign Trade Council. Annual meeting at the Grunewald Hotel, New Orleans, La., April 25 to 27, 1923. O. K. Davis, Secretary, 1 Hanover Square, New York City.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society of Mechanical Engineers. Spring meeting at Montreal, Can., May 28 to 31. Calvin W. Rice, 29 W. 39th St., New York City.

American Society for Testing Materials. Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Society of Automotive Engineers. Summer Meeting. Spring Lake, N. J., June 19 to 23.

American Society for Steel Treating. Eastern sectional meeting, Bethlehem, Pa., June 14 and 15. Hotel reservations through George C. Lilly, Superintendent of Heat Treatment, Bethlehem Steel Co., Bethlehem, Pa.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Trend of pig-iron prices higher due to wage increases in Southern ore and coal mines. Minimum of $2.20 per 100 lb. on steel plates, shapes and bars disappearing from market. New inquiries have stimulated prices to the current range of $2.25@$2.40. Some mills place a minimum of $2.25 per 100 lb. on plates and shapes, others, $2.35; as high as $2.50 having been quoted as a maximum. Structural buying mostly in small lots, but with inquiries increasing. Plate mills overbooked, especially on car material; quick deliveries impossible. Plate demand running mostly to pipe line, storage tank and locomotive material. Structurals up 15c. per 100 lb. in New York and Cleveland warehouses. Blue annealed sheets advanced 15c. in New York; black, 10c. in Pittsburgh, and galvanized, 10c. per 100 lb. in Pittsburgh and Cleveland.

Copper firm, lead up $1 per ton; tin at new high peak due to drop in visible supply. Zinc advanced ¼c. per lb. in New York. Fabricated brass and copper products higher in New York and Cleveland warehouses, due to rise in metals.

No declines reported.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$29.55
Northern Basic	29.77
Southern Ohio No. 2	31.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.44
BIRMINGHAM	
No. 2 Foundry	25.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	30.14
Virginia No. 2	33.17
Basic	28.50
Grey Forge	29.00
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.00
Basic	28.00
Bessemer	28.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6
Cincinnati	4½@6
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.75	4.34	3.65	4.00
No. 12	2.60@2.85	4.39	3.70	4.05
No. 14	2.70@2.95	4.44	3.75	4.10
No. 16	2.90@3.15	4.54	3.85	4.20
Black				
Nos. 17 and 21.	3.20@3.45	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.50	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.55	4.80	4.30	4.75
No. 28	3.35@3.60	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.20	5.55
No. 28	4.35@4.75	5.90	5.50	5.85

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	64	52½	⅜ to 1½	30	13
LAP WELD					
2	57	45½	2	23	7
2½ to 6	61	49½	2½ to 4	26	11
7 to 8	58	45½	4½ to 6	28	13
9 to 12	57	44½	7 to 12	26	11
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	62	51½	⅜ to 1½	30	14
2 to 3	63	52½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	55	44½	2	23	9
2½ to 4	59	48½	2½ to 4	29	15
4½ to 6	58	47½	4½ to 6	28	14
7 to 8	54	41½	7 to 8	21	7
9 to 12	48	35½	9 to 12	16	2

WROUGHT PIPE—Warehouse discounts as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	54%	41%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	51%	38%	53½%	40½%	59½%	45½%

Malleable fittings: Classes B and C, banded, from New York stock sell at list less 1%. Cast iron, standard sizes, 29% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.69	4.51	4.30
Cold rolled strip steel	7.00	8.25	7.25
Floor plates	5.65	5.46	5.50
Cold finished shafting or screw	4.20	3.90	3.95
Cold finished flats, squares	4.70	4.40	4.45
Structural shapes (base)	3.44	3.31	3.05
Soft steel bars (base)	3.34	3.21	2.95
Soft steel bar shapes (base)	3.34	3.21	2.95
Soft steel bands (base)	4.14	3.61	3.70
Tank plates (base)	3.44	3.31	3.02½
Bar iron (2.75 at mill)	3.34	2.91	2.92½
Carbon tool steel	11.00	....	....
Drill rod (from list)	55@60%	40@55%	50%
Electric welding wire:			
5/32	8.50		14.00
⅛	7.00		12.25
11/32 to ¼	6.75		11.00

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			17.62½
Tin, 5-ton lots, New York			48.00
Lead (up to carlots), St. Louis	8.25;	New York	8 87½
Zinc (up to carlots), St. Louis	7.70;	New York	8.15

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	26.00	26.00
Antimony (Chinese), ton spot	8.87½	9.25	8.25
Copper sheets, base	24.50	23.75@24.75	23.00
Copper wire (l.c.l.)	19.12½	20.75	16.25
Copper bars (l.c.l.)	23.00	24.00	19.50
Copper tubing (l.c.l.)	27.50	29.00	23.00
Brass sheets (l.c.l.)	20.87½	24.00	18.75
Brass tubing (l.c.l.)	25.50	29.00	20.50

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (carlots)	19.12½	21.00	15.75
Brass wire (carlots)	21.37½	22.00	.....
Zinc sheets (casks)	10.25	10.75	.....
Solder (⅛ and ¼), (carlots)	30.50	31.50	20.00
Babbitt metal (83% tin)	42.00	49.25	36.00
Babbitt metal (35% tin)	25.00	18.00	.....
Nickel (ingot and shot), Bayonne, N. J.	29.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	55
Hot rolled rods, Grade "A" (base)	50
Cold drawn rods, Grade "A" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled rods "E"—low manganese (base)	54
Manganese nickel hot rolled rods "D"—high manganese (base)	57

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	46.00
Hot rolled sheets (base)			45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	13.50@14.00	13.50	13.50
Copper, heavy, and wire	13.25@13.75	13.25	13.00
Copper, light, and bottoms	11.50@12.00	11.50	12.00
Lead, heavy	6.25@ 6.75	6.50	6.75
Lead, tea	5.75@ 6.00	5.00	5.75
Brass, heavy, yellow	8.25@ 8.75	....	8.25
Brass, heavy, red	11.00@11.50	11.25	10.50
Brass, light	7.00@ 7.50	7.00	7.25
No. 1 yellow brass turnings	8.00@ 8.50	8.00	8.00
Zinc	5.00@ 5.50	4.50	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.00	11.50	14.50
IC,	112 sheets	12.30	11.90	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.10@0.13	$0.15	$0.11½
Cotton waste, colored, per lb.	.07@.12	.12	.08
Wiping cloths, 13½x13½, per lb.	.16	36.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	52.00 per M	.13
Sal soda, 100 lb. lots	2.60	2.40	2 65
Roll sulphur, per 100 lb.	3.40	3.25	3 50
Linseed oil, per gal., 5 bbl. lots	1.01	1.06	1.07
White lead, dry or in oil	100 lb. kegs.	New York,	14.25
Red lead, dry	100 lb. kegs.	New York,	14.25
Red lead, in oil	100 lb. kegs.	New York,	15.75
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		$7.00
Coke, prompt foundry, Connellsville	per net ton		8.00

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10%	50%
1½ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	.....	65-5%
Lag screws, coach screws	40%	.....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	.....	55%
Tap bolts, hex. head, list plus	20%	.....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$4.00	$3.50
Washers, cast iron, ⅜ in., per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, ⅞ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅜-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	50%	40-5%	50%
Copper burs	30%	40-5%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.297	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60%	50-10%	40-10%
Second grade	65%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1 32	1.24	1 40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Calif., Los Angeles—Machine Shop, 1235 West Pico St.—spinning lathe, speed lathe and drill press for power equipment.

Conn., Hartford—Hartford Despatch & Trucking Co., 103 Albany Ave., E. G. Mooney, Pres.—conveying equipment, also minor tools, etc., for proposed warehouse and automobile repair shop.

Ill., Chicago—Progress Machine Wks., 512-14 North La Salle St., C. J. Rubey, Purch. Agt.—power drill presses, No. 2, 3 and 4.

Mass., Boston—P. Campello, 10 Thatcher St., (machine shop)—power press, 2½ or 3 in. stroke, 20 to 30 ton pressure (used).

Mass., West Somerville (Boston P. O.)—W. W. Carlson, 125 Liberty Rd.—16 in. x 6 or 8 ft. Lodge & Shipley lathe, quick change gear, taper, compound rest; 13 in. x 6 ft. Willard lathe, quick change gear or semi-quick change gear, compound rest, taper attachment; Allen or H. & W., single and double spindle, ¾ in. capacity, drill, No. 2 taper; Davis No. 2 keyseater or equal; Garvin automatic tapper, No. 1; Warner & Swasey or equal No. 2 screw machine, back geared for bar and chucking.

Mich., Detroit—Fredrickson Co., 801 Beard Ave—wood top circular saw, wood turning lathe, high speed wood bandsaw, 20 in. drill press and small drill press.

Mich., Detroit—Kessler Sales & Service Co., 4434 Dix Ave.—equipment for automobile repair shop.

Mich., Detroit—Kroger Grocery & Baking Co., 1812 Clay Ave.—general repair shop tools for proposed garage.

Minn., St. Paul—Armour & Co., 323 East 5th St., S. K. Fitch, Mgr.—automobile repair equipment for proposed garage on Rice St. and Como Ave.

Mo., Joplin—Machinery Supply Corp., 317½ Joplin St.—pipe threading and cutting machine, size 8 to 12 in., Bigler & Coller or Landis make.

Mo., Mount Washington—Machine Shop, R. 1, Box 531—13 or 14 in. power lathe.

Mo., St. Louis—Perfection Mfg. Co., 2701 North Leffingwell Ave., (manufacturer of metal and wood specialties)—geared press, size of Swain No. 73.

N. Y., Buffalo—J. Blatz, 453 East Ferry St.—equipment for proposed service station and garage repair shop on Jefferson Ave. and Dodge St.

N. Y., Buffalo—H. Bush, 759 East Delevan Ave.—machinery, tools and equipment for garage, service station and repair shop.

N. Y., Buffalo—Krebs Electrical Shop, 694 East Genesee St., E. Krebs, Purch. Agt.—screw cutting lathe, 9 to 10 in. swing, about 30 in. between centers.

N. Y., Buffalo—D. Metlin, 1235 Fillmore Ave.—garage and repair shop equipment.

N. Y., New York—F. H. Crawford, 299 Bway., (machine and tool dealer)—No. 24 or 25 Bliss knuckle joint embossing press, 400 to 600 ton pressure.

N. Y., Rochester—Liberty Thrift Bank Co., 15½ South Water St.—42 in. power squaring shears.

O., Canton—Timken Roller Bearing Co.—20 grinding machines.

O., Cincinnati—W. O. Hutson, 621 Main St.—garage equipment.

O., Columbus—Valls Eng. Co., Marion Rd., (manufacturer of hoisting and special machinery), R. W. Valls, Pres. and Mgr.—general machinery, including punching machine and grinder.

O., Piqua—Meteor Motor Car Co.—squaring shear.

Ore., Forest Grove—W. F. Hartrampf, (machine shop and garage)—one complete machine lathe, 7 ft. bed, 14 to 16 in. swing.

Pa., Corry—Ajax Iron Wks., Inc., (manufacturer of steam engines, etc.)—machine shop equipment, including press.

Pa., Phila.—W. Bockel & Co., 516 Vine St., (manufacturer of surgical instruments)—automatic lathes, drills, presses and electroplating machinery.

Pa., Phila.—Brown Instrument Co., Wayne and Roberts Aves.—automatic boring machines, lathes, drills, milling and screw machines, etc.

Pa., Pittsburgh—Natl. Tube Co., Frick Bldg.—one bending roll machine for bending 4 in. angles.

Pa., Warren—Warren Garage, Pennsylvania Ave., T. T. Moll, owner—garage and repair shop equipment.

Pa., Wilkes-Barre—County Comrs., County Controller—machine shop equipment, including lathe, press, drill, forge and blacksmithing outfit.

R. I., Providence—G. L. Smith, 24 Calender St.—three wire forming machines.

Tex., Bonham—Crescent Motor Co.—one 16 in., 8 ft. bed, quick change gear engine lathe.

Tex., Dallas—J. E. Gill, 1201 Magnolia St.—garage equipment.

Tex., Dallas—The Shop, 1328 North Beckley St., (machine shop)—power lathe.

W. Va., Logan—Guyan Machine Shop—cylinder grinder and electric hoist with a.c. motor, 3 phase, 60 cycle.

Wis., Milwaukee—R. E. Schlei, 708 32nd St., (garage)—lathe for automobile repair work (used preferred).

Wis., Milwaukee—Wisconsin Steel & Dock Co., Canal and 6th Sts., (marine repairs), F. W. Stevens, Purch. Agt.—three punch presses having wide throats, to punch up to ¾ capacity; one combination angle and plate shear up to ¾ capacity; rolls up to ½ capacity; riveting and chipping hammers; small tools.

Wis., North Milwaukee—Lakeside Bridge & Steel Co., (steel fabricators), V. W. Coddington, Purch. Agt.—one rotary iron planer, 30 in. (used preferred).

Ont., Lindsay—Cole Mfg. Co., Ltd., (manufacturer of lighting fixtures), W. G. Cole, Purch. Agt.—Bliss drill press with power attachment.

Ont., Melbourne—Campbell Bros.—complete equipment for garage and automobile repair shop.

Machinery Wanted

Ala., Jasper—Mountain Eagle Publishing Co., (job printing and newspaper)—mitering and punching machine.

Ala., Tarrant City (Birmingham P. O.)—Natl. Cast Iron Pipe Co.—one 7½ ton and two 3 ton overhead traveling cranes, spans 44 to 56 ft. from center to center, 48 lb. rail.

Calif., San Francisco—Pacific Fruit Express Co., 65 Market St.—$25,000 worth of equipment for proposed additions to ice plant at Roseville.

Conn., Hartford—Bryant & Chapman Co., Woodland St.—dairy equipment.

Fla., Tampa—Kingan & Co., 808 Morgan St., (pork and beef packers)—ice manufacturing machinery and equipment for proposed $90,000 plant.

Ill., Elgin—Kinzie Bros., North State St., (woodwork)—medium size planer.

Ia., Dubuque—T. J. Mullgrew, 197 Jones St.—steam driven ice machinery, large capacity.

Kan., Wichita—Western Newspaper Union, 525 William St.—power job presses, paper cutters, belting, hangers, pulleys, metal cutters and Miller feeders.

Ky., Frankfort—P. E. Treudt, R. R. 2, Box 218—job printing equipment, including linotype, belting, hangers, press and pulleys.

Ky., Livingston—Ohio-Kentucky Fluo-Spar Co.—machinery and equipment for proposed plant.

Mass., Boston—Graham Press, 16 La Grange St.—Universal press, either 13 x 19 in. or 14 x 22 in. with type cabinets (used).

Mass., Boston—Lincoln Engraving Co., 19 High St.—paper cutter, size 25 (used).

Mass., Boston—C. P. Washburn Co., 702 Chamber of Commerce Bldg., (grain dealers)—attrition mill with about 20 in. single or double head, motor driven, for 220 volt a.c. (used).

Mass., Haverhill—Empire Tag & Printing Co.—printing press, 12 x 18 in. Chandler & Price, preferred (used).

Mass., South Boston (Boston P. O.)—Walworth Mfg. Co., 798 1st St.—five annealing furnaces, three presses and a sorting table for proposed foundry for the manufacture of valves and fittings

Mich., Detroit—Dept. of Purchases & Supplies, 700 Marquette Bldg., G. J. Finn, Comr. of Purchases & Supplies—woodworking machinery and equipment, including Model 6 variety saw complete; 30 in. bandsaw complete; No. 16 Universal or hand block sander; vertical single spindle boring machine; single end tenoning machine; No. 1½ single surface planer; 16 in. hand jointer and planer, American No. 1; also spring tempering and drawing furnace for Dept. of Motor Transportation.

Mich., Monroe—L. Mitchell, Mgr., O'Brien St.—paper mill machinery and equipment.

Minn., Duluth—Russell-Miller Milling Co., 25th Ave., S. E., and Marshall St.—machinery for proposed elevator, including shafting, pulleys and belting.

Mo., Boonville—J. W. Bozarth, Box 274—ice plant equipment, including belting, refrigeration plant, pulleys and hangers.

Mo., Kansas City—G. Cooper & Bro., 1825 Grand Ave. (manufacturer of gasoline engines), J. Cooper, Purch. Agt.—power bandsaw.

Mo., Marceline—Walker-Tainton Motor Co.—air outfit, air compressor, tank and electric motor.

Mo., St. Louis—Building Products Mfg. Co., 2218-20 Pine St., J. M. Hartz, Purch. Agt.—chain mortiser for making corner joints.

N. H., Gorham—School Com.—vocational equipment, including saws, tables, lathes and small tools, for proposed high school.

N. H., Milford—G. B. Spring Co., Inc., (box factory)—30 in. single surfacer with sectional rolls feed (used).

N. Y., Antwerp—O. A. Tucker Co., (sawmill and lumber)—one portable forge, saw set and heavy machinist's bench vise.

N. Y., Brownville—The village, F. Page, Pres.—power driven hacksaw for water department.

N. Y., Buffalo—Electro Metals Radiator Corp., c/o F. Abbott, Iroquois Bldg.—machinery and equipment for the manufacture of copper, electro process radiators for plant at Lockport.

N. Y., Buffalo—Federal Concrete Co., Inc., 667 Wyoming Ave.—equipment for the manufacture of concrete blocks.

N. Y., Buffalo—Hoefler Ice Cream Co., 296 Connecticut St.—ice cream making machinery and equipment for large plant at Cleveland, O.

N. Y., Buffalo—Hygrade Oil & Fuel Corp., 1070 Niagara St.—two 20,000 gal. gasoline tanks and pumps.

N. Y., Buffalo—Regulus Realty Co., Inc., c/o W. W. Saperston, 506 Mutual Life Bldg.—equipment, including two 500 gal. gasoline tanks and pumps for proposed service station on Elm and Vine Sts.

N. Y., Buffalo—Standard Oil Co. of New York, 1103 Elk St.—machinery and equipment for proposed barrel plant.

N. Y., Buffalo—B. Woniewicz, 1302 Clinton St.—bakery machinery and equipment, electrically operated.

N. Y., Carthage—D. J. Renaud & Son, 672 West End Ave., (foundry)—band saw and sanding machine for pattern department.

N. Y., Falconer—Amer. Mfg. Co.—woodworking machinery and equipment for proposed addition to factory for the manufacture of wooden specialties, including rulers, pencil boxes, toys, etc.

N. Y., Hornell—Hornell Lumber Co.—lumber mill machinery and equipment, to replace that which was destroyed by fire.

N. Y., Jamestown—L. Lipe—woodworking machinery and equipment for proposed plant at Randolph.

N. Y., Malone—Sulham Mfg. Co., (lumber and mill work), H. P. Wilder, Purch. Agt.—Barnes double planer and mortiser.

N. Y., Medina—F. M. Poler—machinery and equipment for the manufacture of furniture.

N. Y., New York—Consolidated Products Co., 15 Park Row, (textiles)—yarn dryer of the truck type, capacity 2,000 to 2,500 lb. per day (used).

N. Y., New York—Dry Milk Co., 15 Park Row—special machinery, conveyors, shafting and belting for proposed milk factory at Columbus, Wis.

N. Y., New York—Ward Baking Co., Southern Blvd. and St. Marys St.—ammonia tanks, coolers, dough mixers, bread ovens, etc. for proposed bakery at New Haven.

N. Y., Rochester—Buffalo, Rochester & Pittsburgh R.R., D. S. Jones, Asst. to Pres. —coal and ash handling machinery and equipment.

N. Y., Rochester—Hurst Engraving Co., 116 St. Paul St.—engraving machinery and equipment for plant on North Water and Andrews Sts.

N. Y., Rochester—T. H. Symington Co., Lincoln Park—forge shop equipment.

N. Y., Rochester—Taylor Instrument Co., 95 Ames St.—machinery and equipment for proposed printing plant.

N. Y., Sacket Harbor—Fuel & Supply Co., Ambrose St., (building materials, coal and lumber), F. Stearne, Purch. Agt.—two 2½ ton triple chain hoists.

N. Y., Silver Creek—F. R. Thompson Co., Oliver St., (foundry)—oil operated brass furnace.

O., Areanum—Harris Printing Co.—7 column quarto press for power equipment.

O., Bridgeport—Dillon Bros. Machine Co. (machine shop), C. E. Dillon, Mgr.—shafting, belting, hangers and pulleys.

O., Cincinnati—Adler Underwear & Hosiery Mfg. Co., Harrison and Queen City Aves., Purch. Dept.—five model G, Scott & Williams hosiery machines, 84 needle, 12 gauge and 4 in. in diameter (used).

O., Cleveland — R. H. Hinsdale, 604 Bangor Bldg.—complete laundry equipment.

O., Columbus—Triumph Artificial Limb Co., 293 North High St., W. M. Davis, Mgr. —woodworking machinery.

O., East Palestine—W. S. George—machinery and equipment for proposed pottery.

O., Lisbon—Lisbon Clay Products Co.—clay working machinery, to replace that which was destroyed by fire.

O., Nelsonville—Long Hollow Coal Co., H. W. Hawk, Purch. Agt.—shaker screens and other equipment for mill.

O., Tiffin—Tiffin Art Metal Co., Inc.—metal working machinery and equipment.

O., Youngstown—Trucson Steel Co., Albert St. Extension (steel buildings and fabrication)—one 6 ton and one 10 ton crane.

Okla., Dewey—E. J. Evans—refrigeration plant, one ton capacity.

Okla., Pondcreek — Booster Club — complete ice plant equipment.

Okla., Waurika—T. Flack—$2,000 worth of newspaper equipment, including press and paper cutter.

Pa., Allentown — International Radiator Co., (manufacturer of automobile radiators), E. Nicholas, Secy.—machinery and equipment for addition to plant.

Pa., Allentown—H. O. Ritter, 10th St.—machinery for the manufacture of paper boxes.

Pa., Bath—Pocono Fdry. Co.—foundry equipment.

Pa., Bethlehem—Atlas Automobile Tire Co.—tire building machinery.

Pa., Bradford—C. E. Foster, 101 Main St. —complete machinery and equipment for 500 bbl. oil refinery at Bowling Green, Ky.

Pa., Catasauqua—F. Goldsmith & Son—planing mill machinery and equipment.

Pa., Conshohocken—Montgomery Fdry. & Fittings Co.—foundry equipment (new).

Pa., Coudersport — Abbotts-Aldernay Dairies Co., Inc.—machinery and equipment for dairy.

Pa., Coudersport—McCabe Furniture Co., F. Beyer, Secy.—machinery for addition to plant.

Pa., Dale (Clermont P. O.)—Bd. Educ.—vocational equipment for $100,000 school.

Pa., Erie—Erie Lithographing & Printing Co.—complete lithographing and printing machinery and equipment for proposed plant.

Pa., Franklin—Franklin Hospital—mechanical laundry and refrigerating equipment.

Pa., Hazleton—C. H. Derrick—machinery and equipment for complete mechanical dairy.

Pa., Lansdale—Krupp Fdry. Co., Inc.—equipment for proposed cast iron pipe foundry at Quakertown.

Pa., Latrobe—Vulcan Mold & Fdry. Co., S. H. Williams, Purch. Agt.—foundry equipment.

Pa., Lawrenceville—Dairymen's League—milk plant machinery and equipment, to replace that which was destroyed by fire.

Pa., Lebanon—Lebanon Iron Co.—iron working machinery, including puddling mill equipment, etc., to replace that which was destroyed by fire.

Pa., McKees Rocks—Union Bolt & Rivet Co.—two 5 ton and two 7½ ton cranes.

Pa., Montgomery—W. E. Frey—bakeshop equipment.

Pa., Phila.—Cambria Silk Hosiery Co., 176 West Loudin St., L. Weber, Purch. Agt.—Proctor stocking dryer, 250 capacity.

Pa., Phila.—Croftex Mills, Venango and Ruth Sts.—additional broad looms and swivel looms.

Pa., Phila.—J. A. Dougherty, 316 Weightman Bldg.—about 30 or 40 Crompton & Knowles looms, 82 or 84 in. reed space, individual motor drive preferred (used).

Pa., Phila.—Krout & Fite Mfg. Co., 3158 Emerald St., (textiles), J. Block, Purch. Agt.—looms and accessories for addition to plant.

Pa., Pittsburgh—United Eng. & Fdry. Co., Farmers Bank Bldg., A. Sanborn, Purch. Agt.—bucket crane with ¾ yd. bucket for Vandergrift Wks.

Pa., Scranton—Munyon's Homeopathic Remedy Co., 214-16 Lackawanna Ave., C. P. Wynne, Pres.—mixing and percolating tanks; automatic washing, filling, corking, labeling and packing machinery.

Pa., Titusville—Titusville Radiator Wks., A. M. Williams, Mgr.—machinery and equipment for radiator plant, including large air compressor.

Pa., Warren—J. T. Newell, 244 Pennsylvania Ave —additional printing machinery.

Pa., York—Long Box Co., Princess and Newberry Sts., H. W. Stauffer, Mgr.—box making machinery.

R. I., Bristol—Cranston Worsted Co.—complete equipment for proposed mill for the manufacture of worsted goods.

S. C., Union—Excelsior Knitting Mills—several No. 30 Foster coners and Atwood or Sipp silk winders machines.

Tenn., Chattanooga—Dixie Mercerizing Co., Watkins St. along tracks of Belt Ry.—$120,000 worth of mercerizing machinery and winders.

Tenn., Knoxville—B. C. Hodgson, P. O. Box 631—8½ x 10 in. double drum hoisting engine.

Tenn., Murfreesboro — A. F. Todd — textile machinery for the manufacture of woolen sweaters.

Tex., Arlington—S. S. Davidson—blacksmith equipment, including anvil, drill press and grinder.

Tex., Athens—Eureka Coal & Clay Co.—$50,000 worth of mining equipment.

Tex., Fort Worth—J. Fletcher, 512 Jennings St.—job print shop equipment, including press and paper cutter.

Tex., Lamesa—W. G. York—$5,000 worth of gin equipment.

W. Va., Clarksburg—C. P. Lynch, Gore Hotel—machinery for the manufacture of mattresses.

W. Va., Parkersburg—Kesterson Ice Co. —ice manufacturing machinery and equipment for proposed plant.

Wis., Fox Lake — North Amer. Casket Co., c/o W. C. O'Connell, (manufacturer of caskets, toys, etc.)—woodworking machinery, including large planer, band saws, cross cut saws and motors.

Wis., Kenosha—A. Allen Co., 1000 Prairie Ave.—textile machinery for proposed factory for the manufacture of hosiery and underwear.

Wis., Madison—Randall Service Station, Warren and Monroe Sts., F. W. Breuch, Mgr.—air compressor and free air equipment.

Wis., Manitowoc—Globe Steam Laundry, 14th St. and Washington Ave., E. Hemple, Mgr.—machinery, including tumbler, dryer, etc., for proposed laundry.

Wis., Milwaukee — B. Adelman, 1627 North Ave.—power driven laundry machinery, including manglers, washers, mechanical dryers, belting, shafting and hangers.

Wis., Milwaukee—Flach & Braun, 723 41st St., (woodwork), H. Flach, Purch. Agt.—combination machine to include saw table, jointer and borer (used preferred).

Wis., Milwaukee—D. Mallinger, 943 45th St.—one Universal woodworking machine to include bandsaw, cutoff saw, rip saw and planer, motor driven.

Wis., Milwaukee — A. A. Schulist, 780 Holton St., (printer)—one medium size paper cutting machine.

Wis., Oshkosh—Gustavus Milling Co., 506 Minnesota St., H. F. Gustavus, Mgr.—power and grinding machinery for proposed flour mill, etc.

Wis., Seymour—M. G. Hallada—refrigeration machinery, several ton capacity.

Wis., Sheboygan—Holman Mfg. Co., 1910 North 13th St.—electric power machinery and special machinery for proposed overall and garment factory at Wittenberg.

Ont., Fort William — Western Terminal Elevator Co.—conveying apparatus for handling grain.

Ont., Listowel—Perfect Knit Mills, Ltd., M. K. Becker, Pres.—complete machinery for proposed knitting mill.

Ont., London — London Metal Products Co., (manufacturer of electric washing machines), C. A. Raftrey, Mgr.—metal and woodworking machinery.

Ont., Tillsonburg—Norfolk Shoe Co., L. C. Greel, Supt.—equipment for proposed shoe factory.

Ont., Toronto—Fesserton Timber Co., 15 Toronto St.—machinery and equipment, capacity 90,000 ft. per day, for proposed sawmill near Timmins.

Que., Montreal—E. Bessette, 14 Prince George St.—complete equipment for proposed foundry on Moreau and Forsythe Sts.

Que., Montreal—Canadian Pacific R.R., Windsor Sta., I. M. R. Fairbairn, Ch. Engr. —mechanical coaling plants for Jackfish, Ont., and Megantic, Que.; steel water tanks, 60,000 to 100,000 gal. capacity, for McAdam Jct., N. B., St. Johns, Que.; Guelph Jct., Memegos, Markstay and Grassett, Ont.; electrical interlocker to control traffic at Westmount and Glen Yards, Montreal, Que.; 90 ft. turntable at MacLier, Ont.; mechanical and car equipment for Hochelaga, Glen Yard and Place Viger, Montreal, Que., Smith Falls, Toronto and North Bay, Ont.

Que., St. Lambert—Liberty Tire & Rubber Co., St. James St.—machinery for proposed tire factory.

Metal Working Shops

Calif., Emeryville—The Doble Steam Motors Co., 714 Harrison St., San Francisco, plans to build the first unit of an automobile factory on Haven, Harlin and Park Sts., along tracks of Atchison, Topeka and Santa Fe R.R., here. Estimated cost $100,000, ultimate cost $350,000. Engineer or architect not selected.

Calif., Fresno—The Herminghaus Estate awarded the contract for the construction of a garage on L St. between Tuolumne and Merced Sts. Estimated cost $40,000. Waterman Bros., Tulare and L Sts., lessees. Noted Dec. 21.

Calif., Los Angeles—P. B. Fletcher, et al., c/o Walker & Eisen, Archts., Pacific Finance Bldg., are having plans prepared for the construction of a 9 story garage and store building on 6th and Kenmore Sts.

Calif., Los Angeles—The Ford Motor Car Co., 7th and Santa Fe Sts., awarded the contract for the construction of assembling plant buildings, including shops, etc. Estimated cost $175,000, ultimate cost $275,000. Noted Feb. 1.

Calif., Los Angeles—The Union Pacific R.R., 610 South Main St., awarded the contract for the construction of a power house, garage, car repair and blacksmith shop, boiler shops, traveling cranes and round house in the vicinity of Belvedere Gardens. Estimated cost $500,000. Noted Jan. 11.

Calif., Orland—The Ford Garage Agency awarded the contract for the construction of a 1 story, 80 x 100 ft. garage on 5th and Swift Sts. Noted Feb. 15.

Calif., San Francisco—H. C. Wood, 166 King St., is having plans prepared for the construction of a 1 story, 75 x 80 ft. machine shop on Stillman St. near 3rd St. Estimated cost $10,000. Private plans.

Calif., Stockton—H. H. Meyers, Archt., Kohl Bldg., San Francisco, is receiving bids for the construction of a 1 or 2 story, 80 x 100 x 150 ft. garage on Hunter and Channel Sts., here, for the Cowell Lime & Cement Co., c/o W. H. George, Purch. Agt., 2 Market St., San Francisco. Noted Dec. 28.

Conn., East Hartford—The Hartford Despatch & Trucking Co., 103 Albany Ave., Hartford, awarded the contract for the construction of a 4 story, 80 x 100 ft. warehouse, garage and machine shop on Prospect St., here. Estimated cost $100,000. E. G. Mooney, Pres.

Conn., Hartford—J. Dolin, 29 Windsor Ave., is receiving bids for the construction of a 1 story, 55 x 152 ft. garage, including service station and repair departments. Estimated cost $40,000. C. J. Malmfeldt, 118 Asylum St., Hartford, Archt.

Conn., Hartford—A. Goldstein, 593 Windsor Ave., is receiving bids for the construction of a 1 story, 80 x 210 ft. garage and service station. Estimated cost $40,000. F. C. Walz, 407 Trumbull St., Hartford, Archt.

Conn., Meriden — The Connecticut Telephone & Electric Co., 70 Britannia St., plans to build a large 1 story addition to its plant for the manufacture of electrical goods. Engineer or architect not announced.

Conn., Newington—The Acme Mchy. & Equipment Co. plans to build a 1 story, 100 x 225 ft. factory for the manufacture of machinery. Estimated cost $80,000. Engineer or architect not announced.

Del., Edgemoor—The Edgemoor Iron Co. awarded the contract for the construction of a 2 story, 98 x 369 ft. machine shop. Estimated cost $75,000.

Ill., Chicago—C. J. Dempsey, 2302 West Madison St., is receiving bids for the construction of a 2 story, 103 x 125 ft. automobile service station on Warren and Oakley Sts. Estimated cost $75,000. J. L. McConnell, 111 West Jackson Blvd., Engr. and Archt.

Ill., Chicago—The R. B. Hayward Co., 849 West Ohio St., awarded the contract for the construction of a 1 story, 253 x 256 ft. factory for the manufacture of ventilating systems, tanks, etc., on Sheffield and Marcy Sts. Estimated cost $50,000.

Ill., Oak Park—Weller & Rippel, Archts., 140 South Dearborn St., Chicago, are receiving bids for the construction of a 1 story, 100 x 200 ft. garage and sales station at 830-36 North Blvd. for the owner, c/o Wulpi Garage, 811 West Harrison St., here. Estimated cost $100,000.

Ill., Peru—The Western Clock Co. awarded the contract for the construction of a 2 story factory. Estimated cost $250,000. Noted Dec. 28.

Ind., Brazil—The Brazil Machine & Fdry. Co. plans to rebuild its plant for the manufacture of clay working machinery, which was destroyed by fire. Estimated cost $30,000. Engineer or architect not announced.

Ind., New Albany—The Natl. Hame & Chain Co. plans to rebuild its factory which was destroyed by fire. Estimated cost $100,000. Engineer or architect not announced.

Ind., South Bend—The Studebaker Corp., Main and Bronson Sts., awarded the contract for the construction of a 6 story, 100 x 820 ft. automobile body plant on Lafayette Blvd. Noted Jan. 18.

Kan., Pittsburg—The Pittsburg Boiler & Mch. Co., 3rd and Olive Sts., will build a 60 x 145 ft. factory, 45 ft. high. Estimated cost $25,000.

Mass., Chicopee—The Moore Drop Forge Co., 38 Walter St., Springfield, awarded the contract for the construction of a 1 story, 76 x 103 ft. heat-treating factory, here. Estimated cost $60,000.

Mass., South Boston (Boston P. O.)—The Walworth Mfg. Co., 798 1st St., awarded the contract for the construction of a 1 story, 51 x 108 ft. foundry for the manufacture of valves and fittings. Estimated cost $30,000.

Mass., Springfield—The Standard Electric Time Co., 89 Logan St., awarded the contract for the construction of a 3 story, 50 x 90 ft. addition to its plant for the manufacture of electric clocks. Estimated cost $60,000. Noted Jan. 11.

Mich., Detroit — The Kessler Sales & Service Co., 4434 Dix Ave., awarded the contract for the construction of a 2 story, 70 x 130 ft. garage and service station. Estimated cost $47,000. Noted Sept. 14.

Mich., Detroit—The Kroger Grocery & Baking Co., 1812 Clay Ave., is having plans prepared for the construction of a 1 story 50 x 150 ft. garage and repair shop on Merritt and Junction Aves. Estimated cos $40,000. J. G. Kastler & Co., 523 Detroit Savings Bank Bldg., Detroit, Archts.

Mich., Holland—The Federal Stamping Co. is receiving bids for the construction of a 1 story, 100 x 260 ft. factory on River St. Estimated cost $100,000. Private plans.

Mich., Marshall—A. B. Chanel, Archt., Post Bldg., Battle Creek, is receiving bids for the construction of a 1 story, 130 x 250 ft. factory, to replace the one which was destroyed by fire, for the Marshall Furnace Co., here. Estimated cost $40,000.

Minn., Albert Lea—The Amer. Gas Machine Co. awarded the contract for the construction of a 5 story, 65 x 132 ft. factory. Estimated cost $75,000.

Minn., Minneapolis—The Bd. Educ., 305 City Hall, is having plans prepared for the construction of a 2 story storehouse and shop building on 3rd St. N. and 9th Ave. Estimated cost $150,000. G. F. Womrath, Business Supt., Bureau of Bldgs., Division of Design & Inspection, Bd. of Educ., Archts.

Minn., Minneapolis — The Murphy Transfer Co., 309 3rd Ave., will soon award the contract for the construction of a 2 story, 68 x 149 ft. warehouse and garage on 4th St. and 9th Ave. N. Estimated cost $155,000. Lang, Raugland & Lewis, 627 Metropolitan Bank Bldg., Minneapolis, Archts.

Minn., Minneapolis — The State Bd. of Control, Capitol, awarded the contract for the construction of a 3 story store house and shop building at the State University. Estimated cost $119,000. D. F. Mullen, Secy.

Minn., St. Paul—The Twin City Motor Car Co., 1428 Harmon Pl., awarded the contract for the construction of a 2 story, 60 x 138 ft. garage and sales room on 5th and Exchange Sts. Estimated cost $56,341. Noted Feb. 8.

Mo., Kansas City—W. Jewell, Jr., 227 Rialto Bldg., will build a 2 story, 93 x 132 ft. garage on 9th and Oak Sts. Estimated cost $65,000.

Mo., St. Louis—The Laclede Gas Light Co., 11th and Olive Sts., is receiving bids and will open same about Mar. 10 for the construction of a 1 and 2 story, 100 x 175 ft. garage and workship on Forest Park Blvd. Estimated cost $50,000. V. Moore, c/o owner, Engr.

Mont., Billings—J. Gerson plans to build a 2 story, 136 x 200 ft. garage on North 27th St. and Minnesota Ave. Estimated cost $60,000. Engineer or architect not announced.

N. H., Portsmouth—The Portsmouth Automobile Body Co. will soon award the contract for the construction of a 2 story, 40 x 100 ft. addition to its plant on Elm St. Estimated cost $30,000. J. E. Richardson, 56 Grove St., Dover, Archt.

N. J., Trenton — The New Jersey Twin Hoist Co., 201 Calhoun St., awarded the contract for the construction of a manufacturing plant. Estimated cost $100,000.

N. Y., Buffalo—The Niagara Blower Co., 486 Howard St., awarded the contract for the construction of a 1 story, 60 x 160 ft. factory at 673 Ontario St. Noted Feb. 8.

N. Y., Buffalo—The Peerless-Husker Co., 501-23 Cornwall Ave., awarded the contract for the construction of an addition to its canning machinery plant. Estimated cost $10,000. Noted Feb. 15.

N. Y., Clarence—The Buffalo Tractor Co. has purchased site and plans to build an addition to its factory for the manufacture of tractors. Estimated cost $50,000. Engineer or architect not selected.

N. Y., Elmira Heights (Elmira P. O.)—The Amer. Bridge Co. is receiving bids for the construction of template shop, to replace the one which was recently destroyed by fire. Cost between $100,000 and $125,000. R. T. Lewis, Mgr.

N. Y., Rochester—The Cullinan-Malcolm Co., Inc., 4322 Lake Ave., plans to build a 50 x 150 ft. garage, automobile sales and service station. Estimated cost $40,000. Engineer or architect not announced.

O., Cincinnati — The Williamson Heater Co., 335 West 5th St., manufacturer of hot air furnaces, awarded the contract for the construction of a 1 story, 100 x 400 ft. factory. Estimated cost $150,000.

O., Cleveland—The L. L. Carlozzi Co., 1258 East 105th St., Ford dealers, having plans prepared for the construction of a 2 story, 101 x 120 ft. sales station and garage on Ansel Rd. and Superior Ave. Estimated cost $150,000. W. S. Ferguson Co., 1900 Euclid Ave., Cleveland, Archts.

O., Cleveland — The Clover Meadow Creamery Co., 1823 East 55th St., awarded the contract for the construction of a 1 story, 80 x 92 ft. garage on East 57th St. and Belvidere Ave. Estimated cost $40,000. J. S. Kofron, Treas. Noted Jan. 25.

O., Cleveland—The H. J. Hunger Brass Co., 928 Champlain Ave., is having plans prepared for the construction of a 1 story, 89 x 139 ft. foundry. Estimated cost $60,000. R. H. Hunger, Pres. Wittington-Roberts-Wright Co., Swetland Bldg., Cleveland, Archts.

O., Cleveland—The Ohio Ice Machine Co., 1579 Columbus Rd., awarded the contract for the construction of a 1 story, 48 x 100 ft. factory at 1931 West 47th St. Estimated cost $20,000.

O., Cleveland—The Perfection Trailer & Mfg. Co., 1453 West 110th St., awarded the contract for the construction of a 2 story, 100 x 200 ft. factory. Estimated cost $60,000. H. L. Hohlfelder, Genl. Mgr. Noted Feb. 15.

O., Cleveland—The Sterling Mfg. Co., 2845 Prospect Ave., manufacturer of automobile accessories, awarded the contract for the construction of a 2 story, 67 x 100 ft. addition to its factory at 2831 Prospect Ave. Estimated cost $75,000. W. M. Scott, Mgr.

O., Cleveland—The Studebaker Corp. of America, 2020 Euclid Ave., will soon award the contract for the construction of a 3 story, 54 x 190 ft. salesroom and garage at 2000 Euclid Ave. Estimated cost $300,000. E. J. Murane, Mgr. W. S. Ferguson Co., 1900 Euclid Ave., Cleveland, Archts.

O., Cleveland — J. W. Wilson, Fidelity Mortgage Bldg., awarded the contract for the construction of a 2 story, 45 x 100 ft. workshop at 5205 Euclid Ave. Estimated cost $40,000.

O., Dayton—The Standard Register Co., Albany St., awarded the contract for the construction of a 2 story office and shop building. Estimated cost $100,000.

O., Mansfield—The Barnes Mfg. Co., 701 North Main St., manufacturer of pumps, etc., has had plans prepared for the construction of a 1 story, 73 x 261 ft. addition to its factory and foundry. Estimated cost $75,000. G. S. Rider & Co., Century Bldg., Cleveland, Archts.

O., Norwood (Cincinnati P. O.) — The Henderson Lithographing Co., 4530 Main Ave., will soon award the contract for the construction of a 1 story, 70 x 130 ft. factory. Estimated cost $150,000. Tietig & Lee, 901 4th Natl. Bank Bldg., Archts.

O., Shelby—The Shelby Spring Hinge Co., c/o L. D. Malone, Mgr., has had plans prepared for the construction of a 2 story, 40 x 162 ft. addition to its factory. W. D. Spengler, Hanna Bldg., Cleveland, Engr.

O., Youngstown—The Truscon Steel Co., Albert St., will build two 1 story, 80 x 200 ft. and 80 x 400 ft. additions to its steel plant.

Pa., Altoona—Birshitz & Goldberg, 2214 Beale Ave., are having plans prepared for the construction of a 2 or 3 story, 50 x 150 ft. garage at 2210 Beale Ave. Estimated cost $40,000. Private plans.

Pa., Ardmore—J. C. Norton, Archt., is receiving bids for the construction of a 1 story, 60 x 145 ft. garage for the Hale Motor Co. Estimated cost $60,000.

Pa., Bryn Mawr—P. H. Tyre, Archt., 1509 Arch St., Phila., is receiving bids for the construction of a 1 story, 85 x 127 ft. garage and sales station, here, for the Neel-Cadillac Co., 142 North Broad St., Phila. Estimated cost $50,000.

Pa., Erie—The Erie Fdry. Co., 12th St., will soon award the contract for the construction of a 2 story, 35 x 70 ft. addition to its foundry. Estimated cost $20,000. Osborn Eng. Co., 2848 Prospect Ave., Cleveland, O., Engrs. and Archts.

Pa., Hatboro—The Austin Co., Engrs., Bulletin Bldg., Phila., is receiving bids for the construction of a 3 story, 60 x 200 ft. and 2 story, 40 x 150 ft. plant for the manufacture of stoves, here, for the Roberts & Manders Stove Co., 11th and Washington Sts., Phila.

Pa., Lebanon—The Lebanon Iron Co. plans to rebuild its iron works, which were destroyed by fire. Cost between $200,000 and $250,000. Engineer or architect not announced.

Wis., Green Bay—The Bay Verte Machine Co. plans to build a 2 story, 50 x 95 ft. repair and machine shop. Estimated cost $50,000. W. Hinklo, Mgr. Engineer or architect not selected.

Wis., Manitowoc—The Wiese Laboratory Fixture Co. plans to build a 2 story, 70 x 80 ft. addition to its factory for the manufacture of steel and wood fixtures. Estimated cost $50,000. F. H. Wiese, Pres. Engineer or architect not selected.

Wis., Stevens Point—J. E. Moyer, Archt., 230 Madison St., is receiving bids for the construction of a 2 story, 68 x 124 ft. garage, on Church and Main Sts., for R. E. Newby, 201 Clark St. Estimated cost $40,000. Noted Feb. 1.

Wis., Wisconsin Rapids—The Blue Seal Iron Co. plans to build a 2 story shop for the manufacture of castings for refrigeration machinery. Estimated cost $40,000. O. R. Roennis, Mgr. Engineer or architect not selected.